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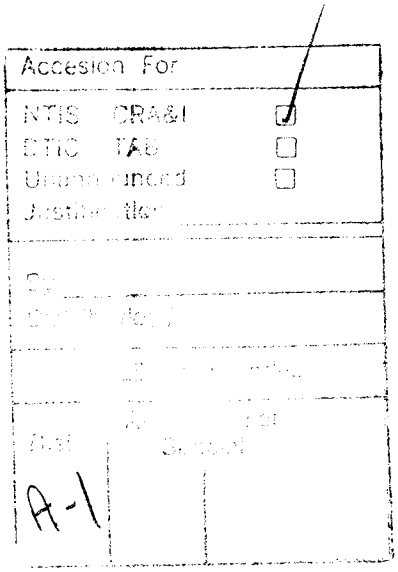
60% Design Cost Estimate
Interim Action
Rocky Mountain Arsenal
Basin F



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U.S. Army Corps of Engineers
Omaha District
Omaha Nebraska

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Project No. 86C8554P

REPORT DOCUMENTATION PAGE

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13. ABSTRACT (Maximum 200 words)

COST ESTIMATES FOR THE FOLLOWING:

1. RIP-RAP REMOVAL
2. GRADING
3. CLAY FOR CAPPING AND LINING
4. WASTE PILE SELECT FILL
5. TOPSOIL
6. SUMPS AND PIPING
7. DEBRIS REMOVAL
8. HAULING WASTE
9. SOLIDIFICATION
10. ROADS
11. FILTER
12. DRAINAGE NET.

14. SUBJECT TERMS

LINERS, SOLIDIFICATION, TRANSPORT, COST

15. NUMBER OF PAGES

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17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

BASIN F 60% DESIGN COST ESTIMATE W/ 2 FT. CLAY LINER & CAP

STAGE ONE CONSTRUCTION			
REMOVE RIP RAP (SO. END)	6,250 C.Y.	$5.50	$34,375.00
REGRADE SOUTH BERM	32,250 C.Y.	$2.66	$85,785.00
HAUL SLUDGE TO STOCKPILE	91,370 C.Y.	$2.66	$243,044.20
CLAY CAP (2 FT.)	48,070 C.Y.	$6.87	$330,240.90
		SUBTOTAL	$693,445.10
LANDFILL CONSTRUCTION			
EXTERIOR BERMS	20,200 C.Y.	$7.34	$148,268.00
CLAY LINER-BOTTOM (2 FT.)	43,300 C.Y.	$7.34	$317,822.00
CLAY LINER-TOP&SIDES (2 FT.)	51,970 C.Y.	$10.78	$560,236.60
INTERNAL GRADING	48,600 C.Y.	$2.66	$129,276.00
SELECT FILL (2 FT.)	56,760 C.Y.	$7.59	$430,808.40
TOP SOIL (6 IN.)	13,000 C.Y.	$2.93	$38,090.00
DRAINAGE NET(3 LAYERS)	1,986,410 S.F.	$0.35	$695,243.50
SYNTHETIC LINER(2 LAYERS)	1,307,160 S.F.	$0.80	$1,045,728.00
GEOTEXTILE FABRICS(3 LAYERS)	1,986,410 S.F.	$0.25	$496,602.50
SUMPS AND PIPING	1 L.S.	$36,120.00	$36,120.00
		SUBTOTAL	$3,898,195.00
NORTH LAGOON (8.5 M GAL)			
EXCAVATION	54,000 C.Y.	$2.66	$143,640.00
CLAY LINER (2 FT.)	11,000 C.Y.	$7.34	$80,740.00
SYNTHETIC LINER(2 LAYERS)	296,600 S.F.	$0.80	$237,280.00
DRAINAGE NET(1 LAYER)	148,300 S.F.	$0.35	$51,905.00
		SUBTOTAL	$513,565.00
LEACHATE LAGOON (1.5 M GAL)			
EXCAVATION	10,000 C.Y.	$2.66	$26,600.00
CLAY LINER (2 FT.)	3,750 C.Y.	$7.34	$27,525.00
SYNTHETIC LINER(2 LAYERS)	101,250 S.F.	$0.80	$81,000.00
DRAINAGE NET(1 LAYER)	50,625 S.F.	$0.35	$17,718.75
		SUBTOTAL	$152,843.75
LIQUID REMOVAL			
PUMPS AND APPURTENANCES	1 L.S.	$63,192.00	$63,192.00
FORCE MAIN	1 L.S.	$298,617.00	$298,617.00
ELECTRICAL	1 L.S.	$18,514.00	$18,514.00
O & M	600 HRS	$13.76	$8,256.00
		SUBTOTAL	$388,579.00
CONTAMINATED MATERIAL REMOVAL			
REMOVE RIP RAP	18,750 C.Y.	$5.50	$103,125.00
REMOVE SEWER AND MISC.	15,000 C.Y.	$4.88	$73,200.00
HAUL WASTE TO SOLIDIFICATION	337,540 C.Y.	$4.08	$1,377,163.20
HAUL TO WASTE PILE	337,540 C.Y.	$4.32	$1,458,172.80
		SUBTOTAL	$3,011,661.00
SOLIDIFICATION			
FACILITIES CONSTRUCTION	1 L.S.	$442,344.00	$442,344.00
EQUIPMENT	1 L.S.	$730,572.00	$730,572.00
ELECTRICAL	1 L.S.	$178,752.00	$178,752.00
ELECTRICAL POWER	1 L.S.	$71,400.00	$71,400.00
FLY ASH	40,000 C.Y.	$28.70	$1,148,000.00

O & M	1 L.S.	$1,197,566.00	$1,197,566.00
ADDITIONAL CHEMICALS	1 L.S.	$4,670.00	$4,670.00
		SUBTOTAL	$3,773,304.00
SITE IMPROVEMENTS			
ROADWAYS (25 FT.) LEVEL B	4,167 C.Y.	$11.33	$47,212.11
ROADWAYS (25 FT.) LEVEL D	2,315 C.Y.	$9.89	$22,895.35
SIGNING	1 L.S.	$10,000.00	$10,000.00
FENCING (6' W/ 3 BARBS)	6,000 L.F.	$12.00	$72,000.00
		SUBTOTAL	$152,107.46
RUNOFF/DUST CONTROL			
PUMPING	1 L.S.	$50,000.00	$50,000.00
DIKES	25,000 L.F.	$1.00	$25,000.00
DUST CONTROL	1 L.S.	$50,000.00	$50,000.00
		SUBTOTAL	$125,000.00
LEACHATE/BLOWDOWN LIQUID HANDLING			
TRANSPORT TO LAGOONS	1,500,000 GAL.	$0.10	$150,000.00
		SUBTOTAL	$150,000.00
EQUIPMENT DECONTAMINATION			
SOLIDIFICATION FACILITY	1 L.S.	$25,000.00	$25,000.00
LAGOONS	2 EA.	$10,000.00	$20,000.00
PUMP STATION AND FORCE MAIN	1 L.S.	$7,500.00	$7,500.00
DECON AREA & MISC.	1 L.S.	$7,500.00	$7,500.00
		SUBTOTAL	$60,000.00
BASIN CAPPING/TOPSOILING			
GRADE AND SHAPE	224,500 C.Y.	$2.66	$597,170.00
CLAY CAP (2 FT.)	215,160 C.Y	$6.87	$1,478,149.20
TOP SOIL (6 IN.)	73,880 C.Y.	$2.93	$216,468.40
SEEDING	510,000 S.Y.	$0.15	$76,500.00
		SUBTOTAL	$2,368,287.60
		TOTAL	$15,286,987.91
		10% CONTINGENCY	$1,528,698.79
		5% MOBILIZATION	$764,349.40
		4% COST GTH MDPT	$611,479.52
		7% SUPERVISION	$1,070,089.15
		12% O & P	$1,834,438.55
		GRAND TOTAL	$21,096,043.32

Subject BASIN F 60% COST ESTIMATE — Project No. 86C8554P

By D. HAWK — Checked By Tom Kelley — Task No. 2

Date 7/7/87 — Date 7/13/87 — File No. 21947

Sheet 1 of 2

STAGE ONE CONSTRUCTION

- MOVE MATERIAL ON SOUTH END OF BASIN AND PLACE CLAY CAP TO ALLOW CONSTRUCTION OF WASTE PILE AND SOLIDIFICATION FACILITY.

• Remove Rip Rap South End

QUANTITY = 1/4 (25,000 CY) = 6250 CY ✓

UNIT PRICE = $5.50/CY ✓
(See Cost Item 1)

COST = 6250 CY × $5.50/CY = $34,375 ✓

• Regrade South Berm

QUANTITY = 1/4 (129,000 CY) = 32,250 CY ✓
(129,000 CY = TOTAL BASIN F BERM QUANTITY)

UNIT PRICE = $2.66/CY ✓
(SEE COST ITEM 2)

COST = 32,250 CY × $2.66/CY = $85,785 ✓

• Haul Sludge to Stockpile

QUANTITY = 91,370 CY ✓

UNIT PRICE = $2.66/CY ✓

COST = 91,370 CY × $2.66/CY = $243,044.20 ✓
(See Cost Item 2)

• Place Clay Cap for Basin

QUANTITY = 91,370 - 43,300 = 48,070 CY ✓
(TOTAL STAGE 1 AREA - AREA OF LANDFILL USING 2 FT THICK CAP)

UNIT PRICE = $1.87/CY ✓ (See Cost Item 3 & 4)

Subject BASIN F 60% COST ESTIMATE

Project No. 86C8554P

By D. HAWK

Checked By Tom Kolby

Task No. 2

Date 7/7/87

Date 7/15/87

File No. 21947

Sheet 2 of 2

· Place Clay Cap for Basin F (continued)

ITEM 3 = $4.42/cy

ITEM 4 = $2.45/cy

TOTAL = $6.87/cy

COST = 48,070 CY × $6.87/cy = $330,240.90

Subject BASIN F 60% COST ESTIMATE

By D. HAWK Checked By Tom Kelley

Date 7/7/87 Date 7/10/87

Project No. 86C8554P

Task No. 2

File No. 21947

Sheet 1 of 3

LANDFILL CONSTRUCTION

- EXTERIOR BERM CONSTRUCTION

  QUANTITY = 20,200 CY ✓

  UNIT PRICE = $7.34/CY (See Cost Items 3 & 5)

  ITEM 3 = $4.42/CY
  ITEM 5 = $2.92/CY
  TOTAL = $7.34/CY ✓

  COST = 20,200 CY × $7.34/CY = $148,268.00 ✓

- CLAY LINER - BOTTOM

  QUANTITY = 43,300 CY ✓

  UNIT PRICE = $7.34/CY ✓ (See Cost Items 3 & 5)

  ITEM 3 = $4.42/CY
  ITEM 5 = $2.92/CY
  TOTAL = $7.34/CY

  COST = 43,300 CY × $7.34/CY = $317,822.00 ✓

- CLAY LINER - TOP AND SIDES

  QUANTITY = 51,970 CY ✓

  UNIT PRICE = $10.78/CY (See Cost Item 6)

  COST = 51,970 CY × $10.78/CY = $560,236.60 ✓

Subject BASIN F 60% COST ESTIMATE | Project No. 86C8554P

By D. HAWK | Checked By Tim Kelley | Task No. 2

Date 7/7/87 | Date 7/13/87 | File No. 21947

Sheet 2 of 3

- INTERNAL GRADING

  QUANTITY = 48,600 CY ✓

  UNIT PRICE = $2.66/CY (See Cost Item 2)

  COST = 48,600 × $2.66/CY = $129,276.00 ✓

- PLACE SELECT FILL (SOIL LAYER)

  QUANTITY = 56,760 CY ✓

  UNIT PRICE = $7.59/CY (See Cost Items 7 & 8)

  ITEM 7 = $1.81/CY ✓
  ITEM 8 = $5.78/CY ✓

  TOTAL = $7.59/CY

  COST = 56,760 CY × $7.59/CY = $430,808.40 ✓

- TOPSOIL

  QUANTITY = 13,000 CY ✓

  UNIT PRICE = $2.93/CY (See Cost Item 9) ✓

  COST = 13,000 CY × $2.93/CY = $38,090.00 ✓

- DRAINAGE NET

  QUANTITY = 1,986,410 SF ✓

  UNIT PRICE = $0.35/SF (See Cost Item 10)

  COST = 1,986,410 SF × $0.35 = $695,243.50 ✓

Subject BASIN F 60% COST ESTIMATE

Project No. 86C8554P

By D. HAWK

Checked By Tom Kelley

Task No. 2

File No. 21947

Date 7/8/87

Date 7/1/87

Sheet 3 of 3

- SYNTHETIC LINER

  QUANTITY = 1,307,160 SF ✓

  UNIT PRICE = $0.80/SF ✓ (See Cost Item 10)

  COST = 1,307,160 SF × $0.80/SF = $1,045,728.00 ✓

- GEOTEXTILE FABRIC

  QUANTITY = 1,986,410 SF ✓

  UNIT PRICE = $0.25/SF (See Cost Item 10) ✓

  COST = 1,986,410 SF × $0.25/SF = $496,602.50 ✓

- SUMPS AND PIPING

  LUMP SUM = $36,120 (See Cost Item 11) ✓

Subject BASIN F 60% COST ESTIMATE

Project No. 86C8554P

By D. Hawk

Checked By Tom Kelly

Task No. 2

File No. 21947

Date 7/8/87

Date 7/12/87

Sheet 1 of 2

NORTH LAGOON CONSTRUCTION

- EXCAVATION

  QUANTITY = 54,000 CY ✓

  UNIT PRICE = $2.66/CY ✓ (See Cost Item 2)

  COST = 54,000 CY × $2.66/CY = $143,640.00 ✓

- CLAY LINER (2 FT.)

  QUANTITY = 2' × 148,300 SF ÷ 27 CF/CY = 10,985 CY

  SAY 11,000 CY ✓

  UNIT PRICE = $7.34/CY (See Cost Items 3 & 5)

  ITEM 3 = $4.42/CY ✓

  ITEM 5 = $2.92/CY ✓

  TOTAL = $7.34/CY

  COST = 11,000 CY × $7.34/CY = $80,740 ✓

- SYNTHETIC LINER (2 LAYERS)

  QUANTITY = 2 × 148,300 SF = 296,600 SF ✓

  UNIT PRICE = $0.80/SF (See Cost Item 10) ✓

  COST = 296,600 SF × $0.80/SF = $237,280 ✓

Subject BASIN F 60% COST ESTIMATE

Project No. 86C8554P

By D. HAWK

Checked By Tom Kelley

Task No. 2

Date 7/8/87

Date 7/13/87

File No. 21947

Sheet 2 of 2

- DRAINAGE NET (1 LAYER)

  QUANTITY = 148,300 SF ✓

  UNIT PRICE = $0.35/SF (See Cost Item 10) ✓

  COST = 148,300 SF x $0.35/SF = $51,905.00 ✓

Subject BASIN F 60% COST ESTIMATE — Project No. 86C8554P

By D. HAWK — Checked By Tom Kelley — Task No. 2

Date 7/9/87 — Date 7/13/87 — File No. 21947

Sheet 1 of 1

LEACHATE LAGOON CONSTRUCTION

- EXCAVATION

  QUANTITY = 10,000 CY

  UNIT PRICE = $2.66/CY (See Cost Item 2)

  COST = $26,600.00

- CLAY LINER

  QUANTITY = 50,625 SF × 2 FT ÷ 27 CF/CY
  = 3750 CY

  UNIT PRICE = $7.34/CY (See Cost Item 3 & 5)

  Item 3 = $4.42/CY
  Item 5 = $2.92/CY

  TOTAL = $7.34/CY

  COST = 3750 CY × $7.34/CY = $27,525.00

- SYNTHETIC LINER (2 LAYERS)

  QUANTITY = 2 × 50,625 SF = 101,250 SF

  UNIT PRICE = $0.80/SF (See Cost Item 10)

  COST = 101,250 SF × $0.80/SF = $81,000.00

- DRAINAGE NET (1 LAYER)

  QUANTITY = 50,625 SF.

  UNIT PRICE = $0.35/SF (See Cost Item 10)

  COST = 50,625 SF × $0.35/SF = $17,718.75

Subject BASIN F 60% COST ESTIMATE | Project No. 86C8554P

By D. HAWK | Checked By Tom Kelly | Task No. 2

Date 7/9/87 | Date 7/13/87 | File No. 21947

Sheet 1 of 1

LIQUID REMOVAL SYSTEM (See Cost Item 12)

• PUMPS AND APPURTENANCES

WATER	$9663.00 ✓
CONCRETE SLABS	$4393.00 ✓
GUARDRAILS	$1645.00 ✓
AIR SUPPLY SYSTEM	19,822.00 ✓
PUMPS	27,668.20 ✓
TOTAL	$63,192.00 ✓

• FORCE MAIN

LABOR	148,857 ✓
MATERIAL	148,748 ✓
EQUIPMENT	1012
TOTAL	$298,617.00 ✓

• ELECTRICAL

BRANCH TO COMPRESSOR PAD	15,672 ✓
LIGHTING TO COMPRESSOR PAD	2842
TOTAL	18,514.00 ✓

• O & M

600 HRS × $13.76/HR = $8256.00 ✓

Subject BASIN F 60% COST ESTIMATE Project No. 86C8554P

By D. HAWK Checked By TSK Task No. 2

Date 7/9/87 Date 7/13/87 File No. 21947

Sheet 1 of 2

CONTAMINATED MATERIAL REMOVAL

- REMOVE RIP RAP

  QUANTITY = 25,000 CY × 3/4 = 18,750 CY ✓

  UNIT PRICE = $5.50/CY (see Cost Item 1) ✓

  COST = 18,750 CY × $5.50/CY = $103,125.00 ✓

- REMOVE SEWER AND MISCELLANEOUS DEBRIS

  QUANTITY = 12,000 CY × 1.25 = 15,000 CY ✓ (O.K.)
  (12,000 CY FROM CLOSURE PLAN, BASIN F ROCKY MOUNTAIN ARSENAL, EBASCO, DECEMBER, 1985 WITH 25% CONTINGENCY)

  UNIT PRICE = $4.88/CY (See Cost Items 13 & 14)

  Cost Item 13 = $4.08/CY ✓
  Cost Item 14 = $0.80/CY ✓

  TOTAL = $4.88/CY ✓

  COST = 15,000 CY × $4.88/CY = $73,200.00 ✓

- HAUL WASTE TO SOLIDIFICATION

  QUANTITY = 362,540 ✓ CY - 25,000 CY ✓ RIP-RAP
  = 337,540 CY ✓

  UNIT PRICE = $4.08/CY (See Cost Item 13)

  COST = 337,540 CY × $4.08/CY
  = $1,377,163.20 ✓

Subject BASIN F 60% COST ESTIMATE

By D. HAWK

Checked By Tom Kelly

Date 7/10/87

Date 7/13/87

Project No. 86C8554P

Task No. 2

File No. 21947

Sheet 2 of 2

- HAUL WASTE TO WASTE PILE

  QUANTITY = 337,540 CY ✓

  UNIT PRICE = $4.32 (See Cost Items 14 & 15)

  Item 14 = $0.80/CY ✓
  Item 15 = $3.52/CY ✓

  TOTAL = $4.32/CY ✓

  Cost = 337,540 CY × $4.32/CY = $1,458,172.80 ✓

Subject BASIN F 60% Cost Estimate | Project No. 86C8554P

By D. HAWK | Checked By Tom Kelly | Task No. 2

Date 7/10/87 | Date 7/13/87 | File No. 21947

Sheet 1 of 1

SOLIDIFICATION (See Cost Item 16)

- FACILITIES CONSTRUCTION

WOOD WALL	$9595.00 ✓
SITE WORK	$19,511.00 ✓
CONCRETE SLAB	413,238.00 ✓
TOTAL	$442,344.00 ✓ *

- EQUIPMENT

FLY ASH TANKS	$128,000.00 ✓
PUG MILLS	$485,698.00 ✓
DUST CONTROL SYSTEM	$22,560.00 ✓
AMMONIA SCRUBBER SYSTEM	$94,314.00 ✓
TOTAL	$730,572.00 *✓

- ELECTRICAL $178,752.00 *✓
- ELECTRICAL POWER $71,400.00 *✓
- FLY ASH $1,148,000.00 *✓
- O & M

MANPOWER	$459,202.00
EQUIPMENT	$738,364.00
TOTAL	$1,197,566.00 *✓

- ADDITIONAL CHEMICALS

H_2SO_4	3800.00
NaClO	360.00
NaOH	510.00
TOTAL	$4670.00 ✓ *✓

Subject BASIN F 60% COST ESTIMATE

By D. Hawk Checked By Tom Kelly

Date 7/10/87 Date 7/13/87

Project No. 86C8554P

Task No. 2

File No. 21947

Sheet 1 of 1

SITE IMPROVEMENTS

- ROADWAYS (LEVEL B)

QUANTITY = 9000 FT × 25 FT × 0.5 FT ÷ 27 CF/CY (c.k.)

= 4167 CY ✓

UNIT PRICE = $11.33/CY (See Cost Item 17) ✓

COST = 4167 × $11.33/CY = $47,212.11 ✓

- ROADWAYS (LEVEL D)

QUANTITY = 5000 FT × 25 FT × 0.5 FT ÷ 27 CF/CY (c.k.)

= 2315 CY ✓

UNIT PRICE = $9.89/CY (See Cost Item 18) ✓

COST = 2315 CY × $9.89/CY = $22,895.35 ✓

- SIGNING

QUANTITY = 50 signs (estimated) ✓

UNIT PRICE = $200/SIGN (estimated) o.k.

COST = 50 × $200/SIGN = $10,000.00 ✓

- FENCING

QUANTITY = 6000 LF (estimated) o.k.

UNIT PRICE = $12.00/LF

(1987 MEANS 2.7-090-0600 o.k.
6' high aluminized steel w/ 3 barbs = $11.51/LF
SAY $12.00/LF

COST = 6000 LF × $12.00/LF = $72,000.00 ✓

Subject BASIN F 60% COST ESTIMATE | Project No. 86C8554P

By D. HAWK | Checked By T. KILL | Task No. 2

Date 7/10/87 | Date 7/17/87 | File No. 21947

Sheet 1 of 1

RUNOFF/DUST CONTROL

- PUMPING

QUANTITY = 5,000,000 gallons (estimated) o.k.

UNIT PRICE = $0.01/gallon

FROM MEANS 1987 2.3-100-0800
8 hrs attended 2" diaphragm pump
Say averages 50 gpm & 8 hrs/day

50 gal/min × 60 min/hr × 8 hr/day = 24,000 gal/day

PRICE = $263.00/DAY

UNIT PRICE = $263.00/DAY ÷ 24,000 gal/day
= $0.01/GAL o.k.

COST = 5,000,000 gal. × $0.01/gal = $50,000.00 ✓

- DIKES

QUANTITY = 25,000 LF (ESTIMATED) o.k.

UNIT PRICE = $1.00/LF (ESTIMATED) o.k.

COST = 25,000 LF × $1.00/LF = $25,000.00 ✓

- DUST CONTROL

COST = $50,000.00 (ESTIMATED) o.k.

Subject BASIN F 60% COST ESTIMATE | Project No. 86C8554P

By D. Hawk | Checked By Tom Kelley | Task No. 2

Date 7/10/87 | Date 7/13/87 | File No. 01947

Sheet 1 of 1

LEACHATE / BLOWDOWN LIQUID HANDLING

- TRANSPORT TO LAGOONS

QUANTITY = 1,500,000 gallons (volume of pond) o.k.

UNIT PRICE = $0.10/gallon

(Use 4,000,000 gal ÷ $388,579.00 ✓
From LIQUID REMOVAL ITEM = $0.10/gallon

Cost = 1,500,000 gal x $0.10/gal = $150,000.00 ✓

Subject BASIN F 60% COST ESTIMATE Project No. 86C8554P

By D. HAWK Checked By Tom Hall Task No. 2

Date 7/10/87 Date 7/13/87 File No. 21947

Sheet 1 of 1

EQUIPMENT DECONTAMINATION

- SOLIDIFICATION FACILITY

  COST = $25,000 (Estimated) O.K.

- LAGOONS

  COST = 2 × 10,000.00 ea = $20,000.00 (ESTIMATED) O.K.

- PUMP STATION AND FORCE MAIN

  COST = $7,500.00 (Estimated) O.K.

- DECON AREA & MISCELLANEOUS O.K.

  COST = $7,500.00 (Estimated)

Subject BASIN F 60% COST ESTIMATE | Project No. 86C8554P

By D. HAWK | Checked By Tom Kelly | Task No. 2

Date 7/10/87 | Date 7/13/87 | File No. 21947

Sheet 1 of 2

BASIN CAPPING/TOPSOILING

- GRADE AND SHAPE

  QUANTITY = 224,500 CY
  (256,750 - 32,250 (STAGE 1))

  UNIT PRICE = $2.66/CY (See Cost Item 2)

  COST = 224,500 CY × $2.66/CY = $597,170.00 ✓

- CLAY CAP (2 FT)

  QUANTITY = 306,530 - 48,070 - 43,300 o.k.
  = 215,160 CY
  (BASIN F PROPER - STAGE 1 CAP - WASTE PILE CAP)

  UNIT PRICE = $6.87/CY (See Cost Items 3 & 4)

  Item 3 = $4.42/CY ✓
  Item 4 = $2.45/CY ✓
  TOTAL = $6.87/CY ✓

  COST = 215,160 CY × $6.87/CY = $1,478,149.20 ✓

- TOPSOIL

  QUANTITY = 73,880 CY o.k.

  UNIT PRICE = $2.93/CY (See Cost Item 9) ✓

  COST = 73,880 CY × $2.93/CY = $216,468.40 ✓

Subject BASIN F 60% COST ESTIMATE

Project No. 86C8554P

By D. Hawk

Checked By Tom Kelly

Task No. 2

File No. 21947

Date 7/10/87

Date 7/13/87

Sheet 2 of 2

- SEEDING

QUANTITY = 510,000 SY o.k.
(105 Acre × 43,560 ÷ 9 = 508,200 SY)

UNIT PRICE = $0.15/SY o.k.
($750.00/ACRE ÷ 43,560 × 9 = $0.15/SY)

COST = 510,000 SY × $0.15/SY = $76,500.00

Chk by RWC

Project RMA-Basin F-WWC | Computed

Subject Quantities | Date 3/17/87 | Sht. | Of

1) Excavate For Wastepile & Solidification Area
810 x 850 = 688,500 S.F. x 2 Ft/27 = 51,000 C.Y.
150 x 300 = 45,000 S.F. x 2 Ft/27 = 3,333 C.Y.
Sa. 500' = 500' x 1,000 x 2/27 = 37,037 C.Y.
91,370 C.Y.

2) Wastepile Berm
2(755 + 805) = 3,120 L.F.
5 x 20 + 5 x 15 = 175 S.F.
(3,120)(175)/27 = 20,222 C.Y. SAY 20,200 CY

3) Clay Blanket for Wastepile → lope yardage
(740 x 790) 4' (110%)/27 = 95,268 C.Y. SAY 95,2
Bottom = 740 x 790 x 2 Ft/27 = 43,300 CY
Top & Sides = 95,270 CY - 43,300 = 51,970 CY

4) Clay for Basin F Proper
[95 A. (43,560) - (740 x 790)] 2/27 = 306,530 ~~143,330~~ C.Y.

5) Topsoil for Wastepile
(740 x 790) 0.5' (120%)/27 = 12,991 C.Y. SAY 13000 C

6) Topsoil for Basin 'F' Proper
[105A. (43,560) - (740 x 790)] 0.5'/27 = 73,874 C.Y.

7) Excavate For Basin F' (Entire Site incl. Wastepile)
362,542 C.Y.

8) Grading For Basin F'
C - 256,744 C.Y. SAY 256,750 CY
F - 271,208 - 20,222 = 255,984 C.Y.
(w/ Berm)

9) Internal Grading (WASTE PILE)
(700' x 750 x 5/2) 27 = 48,611 C.Y. SAY 48,600 CY

10) Select Fill (WASTE PILE)
(810 x 800 x 2/27) 110% = 54,760 C.Y.

11) Stage One Berm Removal
1/4 Berm Vol. (129,000) = 32,250 CY

Chk by ENG

Project ad 42 | Computed

Subject | Date 2-13- | Sht. | Of

Berm = 85,600 C.Y.

Fill = 315,500 C.Y.

Cut (incl. Berm) = 156,000 C.Y.

Rip-Rap Qty.

Chk by EwG

Project Basin F | Computed CAT

Subject Fluid Quantities | Date 1/5/07 | Sht. 1 | Of 1

North Pool

Area = 870,611 S.F.
Ave. Depth = 0.33 ft. (based on info in 23 Oct 86 letter of Holme Roberts & Owen)
Vol. = (870,611)(0.33)(7.481) = 2,149,303 gal.

Southwest Pool

Area = 116,510 - 193 = 116,317 S.F.
Ave. Depth = 0.23 ft. (based on 23 Oct 86 letter)
Vol. = 116,317 (0.23)(7.481) = 200,139 gal.

Southeast Pool

Area = 139,741 S.F.
Ave. Depth = 0.45 ft. (based on 23 Oct 86 letter)
Vol. = 139,741 (0.45)(7.481) = 470,431 gal.

2 S.E. Pools

Area = 7,451 + 5,814 = 13,265 S.F.
Ave. Depth = 0.1 ft. (assumed)
Vol. = 13,265 (0.1)(7.481) = 9,923 gal.

Total Vol. = 2,829,796 gal. as of 10/25/86

Subject LINER QUANTITY

Project No. 86C8554F

By D. HAWK Checked By RWG

Task No. 2

File No. 21947

Date 3/21/87 Date

Sheet 1 of 1

LANDFILL

TOP AREA	500 × 550 =	275,000 SF × 1.02 =	280,5
SIDE AREA	143.7' × 2720 LF =	390,930 SF × 1.02 =	398,75
BOTTOM AREA	810 × 760 =	615,600 SF × 1.02 =	627,91

1,307,160 S

DRAINAGE NETS

1	BOTTOM	= 627,910 × 1	=	627,910
2	TOPS	= 2 × 280,500	=	561,000
2	SIDES	= 2 × 398,750	=	797,500

1,986,410

SYNTHETIC LINERS

1 BOTTOM
1 SIDE
1 TOP

} See above 1,307,160 SF

GEOTEXTILE NETS

1 BOTTOM
2 TOPS
2 SIDS

} SEE DRAINAGE NETS 1,986,410

Subject EXCAVATION FOR NORTH LAGOON

Project No. 86C8554P

By D. HAWK

Checked By T. Kill

Task No. 2

File No. 21947

Date 7/8/87

Date 7/1:/87

Sheet 1 of 1

NORTH LAGOON. QUANTITY FOR EXCAVATION

FROM DESIGN DIMENSIONS 60%

310' @ BOTTOM 12' deep

382' @ TOP

VOLUME

$$\left[\frac{310^2 + 382^2}{2}\right] \times 12' \div 27 \frac{CF}{CY} = 53,783 \text{ CY}$$

$$\left[\frac{310 + 382}{2}\right]^2 \times 12 / 27 = 53,207 \text{ CY}$$

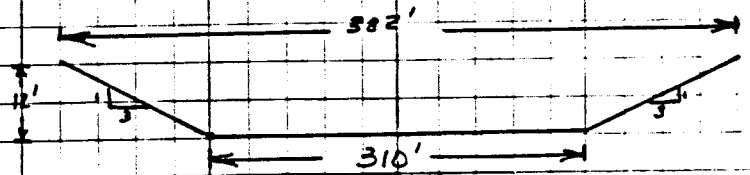
SAY 54,000 CY O.K.

AREA

BOTTOM LENGTH = $2 \times \sqrt{12^2 + 36^2} + 310 = 385'$

AREA = $(385')^2 = 148,225$ SF

SAY 148,300 SF O.K.



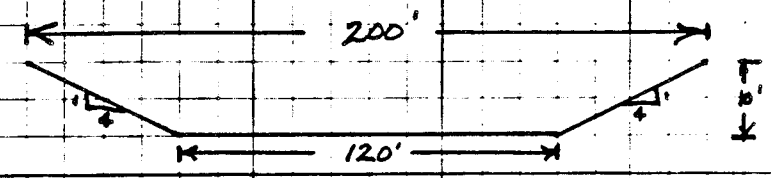
Subject QUANTITIES FOR LEACHATE LAGOON Project No. 86C855YP

By D. Hawk Checked By T. Kelly Task No. 2

Date 7/9/87 Date 7/13/87 File No. 21947

Sheet 1 of 1

LEACHATE LAGOON (1.5 million gallons)



a) Area of Liner (Use 225' w/ Berms) G.K.

225' × 225' = 50,625 SF ✓

b) Volume of excavation

$$\frac{(200\ FT)^2 + (120\ FT)^2}{2} \times 10\ FT \div 27 \frac{CF}{CY}$$

$$\left[\frac{2 = +120}{2}\right]^2 \times 10/27 =$$

= 10,074 CY 9507cy.

SAY 10,000 CY O.K.

Checked

Project | Computed

Subject | Date | Sht. | Of

5) Area of Excavation Below El. 5188 (Clay Cap would be part of Fill) ≈ 60 A.

Vol. = 60 x 43,560 x 2/27 ≈ 190,000 C.Y.

6) Cover (Site Mtl. for Topsoil)

Area ≈ 110 A.

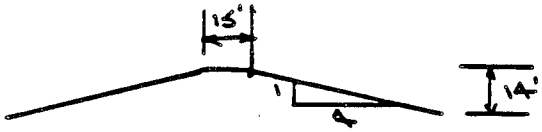
Assume 1 Ft. depth

Vol = 110 (43,560)(1)/27 = 177,500 C.Y.

7) Wastepile Berm Qty

20' ht. pile (25' waste + 3' cover) ≈ 12 A. square

Berm Length = 723' + 7' = 730'



Area = 15x14 + 14(4x14) = 994 S.F.

Vol/L.F. = 994/27 = 36.8 C.Y.

Vol. = 36.8 (4x730) = 107,500 C.Y.

8) Qty Waste (incl Rip-Rap)

393,300 C.Y.

9) Clay Cap

93.5 A. - 3.5A. - 12A ≈ 78 A.

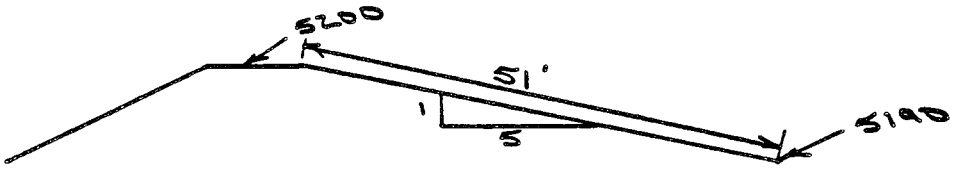
78 x 2 x 43,560/27 = 251,500 C.Y.

Project | Computed | Ck by EWC

Subject | Date 1/27/07 | Sht. | Of

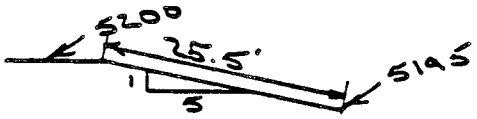
1) Rip Rap Qty

Assume 8"-18" size => 24"± thickness



North Section
Berm @ 200' E. Dock

$11.5" \times (187.71'/1") \times 2' \times 51' \times (1 CY/27 CF) = 8,155$ C.Y.



Basin F-1

$19" \times (187.71'/1") \times 2' \times 25.5' (1/27) = 4,735$ C.Y.

East Side

$7" \times (187.71'/1") \times 2' \times 95' (1/27) = 9,245$ C.Y.

Approx. Rip Rap Qty = 24,135 C.Y. based on 24" thickness
SAY 25,000 C.Y.

2) Berm Qty

From CADD Vol. = 85,600 C.Y.

3) Fill Qty

From CADD Vol. = 315,500 C.Y.

4) Cut (incl. Berm)

From CADD Vol. = 154,000 C.Y.

- Rip Rap Removal Operation

Subject CONTAMINATED RIP RAP REMOVAL

Project No. 86C8554P

By D. HOWE

Checked By T.C.K.

Task No. 4

File No. 21947

Date 1/23/87

Date 1/26/87

Sheet 1 of 1

RIP RAP REMOVAL UNIT RATES

		Daily Rate
1) DOZER 300 HP		$898.00
2) FRONT END LOADER 225 CY		432.00
3) 2 EQUIP OPERATOR	@ 166.00	332.00

ASSUME 7 - 12 YD LOADS/HR
= 100 CY
@ 8 HRS = 800 CY

4) 3 12 YD END DUMPS	@ 278.00	834.00
5) 3 TRUCK OPERATORS	@ 135.00	406.80
		2903.00/DAY

$2900/800 CY = $3.60/CY

W/ SAFETY @ 50% = $1.80/CY

TOTAL $5.40/CY SAY $5.50/CY

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 5-2-87

PROJECT: RMA

PREPARED BY: D. HAWK

CREW REF NO:

LOCATION: DENVER, CO

CHECKED BY: Tom Kelley

CREW COMPOSITION

WORK TYPE: EXCAVATION / HAULING

WORK SCHEDULE:

SPECIAL INFORMATION: RIP RAP REMOVAL HAUL TO STOCKPILE OR WASTE PILE

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST: HOURLY* RATE ($/HR)	LABOR COST: TOTAL FOR CREW ($/HR)	EQUIPMENT COST: HOURLY RATE ($/HR)	EQUIPMENT COST: TOTAL FOR CREW ($/HR)
CAT D8L DOZER	1	16.88	16.88	106.37	106.37
CAT 966 D LOADER	1	16.88	16.88	61.10	61.10
12 CY END DUMP TANDEM AXLE	3	16.78	50.34	37.50	111.90

TOTALS	MANHOURS	5	LABOR COST	84.10	EQUIPMENT COST	279.37

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR: MH/UNIT	LABOR: $/UNIT	EQUIPMENT $/UNIT	COMMENTS
EXCAVATION / HAULING	98 CY/HR		$0.86/CY	$2.85/CY	
SAFETY			—	$1.95/CY	
TOTAL EQUIPMENT, LABOR & SAFETY	→			→	$5.66/CY ✓
					USE $5.50/CY AS O.K.
					IN PREL. ESTIMATE

*Including fringe benefits

DA FORM 5419-R, Apr 85

(17A)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE

DATE PREPARED: 5/2/87

PROJECT: RMA	PREPARED BY: D. Hawk	CREW REF NO
LOCATION: Denver, Co	CHECKED BY: T. Kelly	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		Rip Rap Removal Haul to Stock Pile or Waste Pile

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
Heavy Equipment	5	—	—	38.20	191.00
TOTALS — MANHOURS		LABOR COST	—	EQUIPMENT COST	191.00

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR MH/UNIT	LABOR $/UNIT	EQUIPMENT $/UNIT	COMMENTS
Safety	98 CY/HR		—	$1.95/CY	

*Including fringe benefits

DA FORM 5418-R, Apr 86

- Sludge Handling
- Stage 1 Stockpiling
- Regrade Berms
- Waste Pile Internal Grading
- North Lagoon Excavation
- Grade and Shape Basin F
- Leachate Lagoon Excavation
- Topsoil Grading

(11)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	D. HAWK	
LOCATION	**CHECKED BY**	
DENVER, CO.	T. Kelley 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION / HAULING		SLUDGE HANDLING STAGG 1 STOCKPILING

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 627 B SCRAPERS	6	17.03	102.18	117.77	706.62
CAT D8L DOZERS	4	16.88	67.52	106.37	425.48
CAT 14G MOTOR GRADER	1	17.03	17.03	75.61	75.61
CAT D6 DOZER	1	16.88	16.88	46.40	46.40
MRS 1-100S TRACTOR W/ DISC	1	16.88	16.89	83.09	83.09
LABORERS	2	12.76	25.52	—	—
CAT 627 B SCRAPERS (STANDBY)	1	—	—	75.37	75.37
TOTALS — MANHOURS	15	LABOR COST	246.01	EQUIPMENT COST	1412.57

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
EXCAVATION / HAULING	870 CY/HR		$0.28/CY	$1.62/CY	
SAFETY	870 CY/HR		$0.18/CY	$0.52/CY	
TOTAL EQUIPMENT WITH LABOR & SAFETY	—				→ $2.66/CY

* Including fringe benefits

DA FORM 5419-R, Apr 86

(11A)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT: RMA

PREPARED BY: D. HAWK

CREW REF NO:

LOCATION: DENVER, CO.

CHECKED BY: T. Kelley 3-18-87

CREW COMPOSITION

WORK TYPE: EXCAVATION / HAULING

WORK SCHEDULE:

SPECIAL INFORMATION: SLUDGE HANDLING STAGE 1 STOCKPILING

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	13	—	—	38.20	496.60
STANDBY HEAVY EQUIPMENT	1	—	—	4.45	4.45
LABORERS	2	78.05	156.10	—	—
TOTALS — MANHOURS		LABOR COST	156.10	EQUIPMENT COST	501.05

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	870 CY/HR		*0.18/CY	*0.58/CY	

*Including fringe benefits

DA FORM 5419-R, Apr 85

Subject LANDFILL CONSTRUCTION - SLUDGE REMOVAL COSTS

Project No. 86C8554P

By TEK

Checked By D. Hauk

Task No. 2

File No. 21947

Date 3/13/87

Date 3/18/87

Sheet 1 of 4

SLUDGE HANDLING : COSTS TO STOCKPILE

The work work will include excavating and hauling excavated material from the solidification area and the landfill area, outside the inner berm, to the sludge stockpile area inside the berm where it will be disced and allowed to drain and dry.

Dozers will be used to excavate material down to the liner and push load scrapers. 2 additional dozers will be used to excavate the material below the liner down to the finished grade. The scrapers will be used to haul material to the sludge stockpile where a light dozer will assist in moving material and a tractor with disc attachment will be used for discing and aerating the material. A motor grader will be used to maintain haul roads to the stockpile and 2 laborers will be used as spotters.

It was assumed that portions of the excavation area and sludge could have rolling resistances as high as 15% to 20%, whereas other parts of the haul would be on haul roads with very low rolling resistance. Thus, an average rolling resistance of 10% was assumed for the haul.

Subject LAND FILL CONSTRUCTION - SLUDGE REMOVAL COSTS Project No. 86C8554P

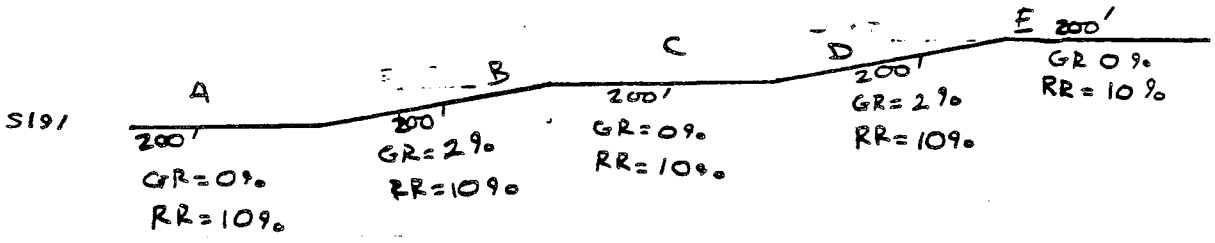
By TCK Checked By D. HAWK Task No. 2

Date 3/13/87 Date 3/18/87 File No. 21947

Sheet 2 of 4

ESTIMATED CYCLE TIMES

HAUL PROFILE (CAT 627 B SCRAPER) FROM BOTTOM OF EXCAVATION TO TOP OF STOCK PILE



HAUL CYCLE	LENGTH	LOADED TR	TIME	UNLOADED TR	TIME
A	200'	10%	0.31	10%	0.22
B	200'	12%	0.35	8%	0.19
C	200'	10%	0.31	10%	0.22
D	200'	12%	0.35	8%	0.19
E	200'	10%	0.31	10%	0.22
TOTAL TIME			1.63 ✓		1.04 ✓
@ 93% ALTITUDE DERATION			1.75 ✓		1.12 ✓

TOTAL ESTIMATED CYCLE TIME

HAUL	1.75 ✓	
RETURN	1.12 ✓	
LOAD	0.8 ✓	SELF LOAD OR PUSH LOAD
MANUEVER & DUMP	0.8 ✓	

4.47 min/cycle @ 100% eff. ✓

Subject LANDFILL-SLUDGE REMOVAL COSTS | Project No. 86C8554P

By T. KELLEY | Checked By D. HAWK | Task No. 2

Date 3/13/87 | Date 3/18/87 | File No. 21947

Sheet 3 of 4

ESTIMATED PRODUCTION:

1) ESTIMATED LOAD

(0.8 ASSUMED LOAD FACTOR)

18 CY x 0.8 LF = 14.4 cy/LOAD ✓

2) CYCLES PER HOUR

$(60\ min/hr.)\left(\frac{1\ cycle}{4.47\ min}\right) = 13.4\ \frac{cycles}{hr.}$ ✓

3) HOURLY UNIT PRODUCTION

$(13.4\ cycles/hr.) \times 14.4\ (C.Y./cycle)$

$= 193\ CY/hr.$ ✓

4) NEED 1 SCRAPER EVERY 0.8 minutes

4.47 min / 0.8 = 5.59 ✓

use 6 scrapers ✓

5) CHECK PUSH DOZER BALANCE

DOZER CYCLE 1.4(0.8) + 0.25 = 1.37 minutes ✓

$\frac{\text{Scraper cycle}}{\text{dozer cycle}} = \frac{4.47}{1.37} = 3.26$ ✓

so use 2 dozers to handle 6 scrapers. ✓

6) FLEET PRODUCTION EFFICIENCY @ 100% EFFICIENCY

6 x 193 CY/hr. = 1,158 CY/hr. ✓

7) ADJUSTED PRODUCTION

(USE 45 min/hr. for level B)

1,158 CY/hr. (45/60) = 870 CY/hr. ✓

Subject LANDFILL CONSTRUCTION - SLUDGE REMOVAL COSTS Project No. 86C8554P

By TEK Checked By D. HAWK Task No. 2

Date 3/13/87 Date 3/18/87 File No. 21947

Sheet 4 of 4

EQUIPMENT AND FLEET COSTS

✓	6	CAT 627 B SCRAPERS @	$134.80	= 808.80 ✓
✓	4	CAT D-8L DOZERS @	123.25	= 493.00 ✓
✓	1	CAT 627 B scraper (standby) @	75.37	= 75.37 ✓
✓	1	CAT 14G MOTOR GRADER @	92.64	= 92.64 ✓
✓	2	LABORERS	12.76	= 25.52 ✓
✓	1	TRACTOR WITH DISC ATTACHMENT		99.97 ✓
✓	1	CAT D-6 DOZER		63.28 ✓
				1658.58 ✓

COST +

$1,658.58/HR ÷ 870 CY/hr. = $1.91/CY ✓

+ Note: No safety considerations taken into account for this cost except 45/60 % efficiency.

- Haul Clay from Borrow to Stockpile

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE

DATE PREPARED: 5/2/87

PROJECT	PREPARED BY	CREW REF NO
RMA	D. Hawk	
LOCATION: Denver, Co	CHECKED BY: Tom Kelly	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
Excavate / Haul		Clay from Borrow to Stockpile

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST: HOURLY* RATE ($/HR)	LABOR COST: TOTAL FOR CREW ($/HR)	EQUIPMENT COST: HOURLY RATE ($/HR)	EQUIPMENT COST: TOTAL FOR CREW ($/HR)
Cat 245 Backhoe	1	17.03	17.03	142.07	142.07
Cat D8L Dozer	1	16.88	16.88	106.37	106.37
Cat D6D Dozer	1	16.88	16.88	46.40	46.40
MRS 1-100S Tractor w/ Disc	1	16.88	16.88	83.09	83.09
10,000 Gallon Water Tanker	1	17.09	17.09	119.02	119.02
End Dump 18 C.Y.	11	17.09	187.99	41.18	452.98

TOTALS	MANHOURS	16	LABOR COST	272.75	EQUIPMENT COST	949.93

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR: MH/UNIT	LABOR: $/UNIT	EQUIPMENT $/UNIT	COMMENTS
Excavate and Haul Clay to Stockpile	310 CY/HR		$0.88/CY	$3.06/CY	Based on quantity estimated after placement
Stripping				$0.48/CY	
Total Excavate, Haul and Strip				→	$4.42/CY
	*Note:	Includes some moisture conditioning			
		and assumes 5 mile haul (1-way)			

*Including fringe benefits

DA FORM 5419-R, Apr 85

(5) ✓

Subject EXCAVATED CLAY COST FOR LANDFILL | Project No. 8623554P
By D. HAWK | Checked By T. K | Task No. 2
Date 2/13/87 | Date 1.1.87 | File No. 21947
Sheet 1 of 9

FROM PRELIMINARY CONSTRUCTION COST ESTIMATES

GIVEN:

- ABOUT 360,000 CY ARE REQUIRED (COMPACTED)
- CLAY IN-PLACE @ 100% COMPACTION
  γ_D = 113.3 pcf
  M_c = 14%
- ASSUMED CLAY IN-SITU
  γ_D = 96.3 pcf
- CLAY SWELL IN TRUCK = 25% vs compacted
  γ_D = 113.3 ÷ 1.25 = 90 pcf

THUS:

AMOUNT OF MATERIAL IN-SITU REQUIRED

$$360{,}000 CY \times \frac{113.3}{96.3} = 423{,}500 CY$$

AREA ASSUMING CLAY IS 5' THICK AND 80% USABLE

$$\frac{1}{.80} \times 423{,}500 CY \times \frac{27 CF}{CY} \times \frac{1}{5 FT} \times \frac{ACRE}{43560 FT^2} = 65.6 ACRE$$

FOR HAULAGE BY VOLUME

$$360{,}000 \times \frac{113.3}{90} = 453{,}200 CY$$

Subject Clay borrow Cost Estimate

Project No. 86C8554P

By D. Hawk

Checked By T I

Task No. 2

File No. 21947

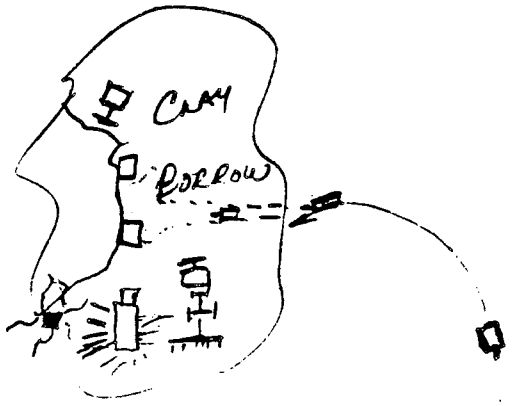
Date 2/13/87

Date 3/2/87

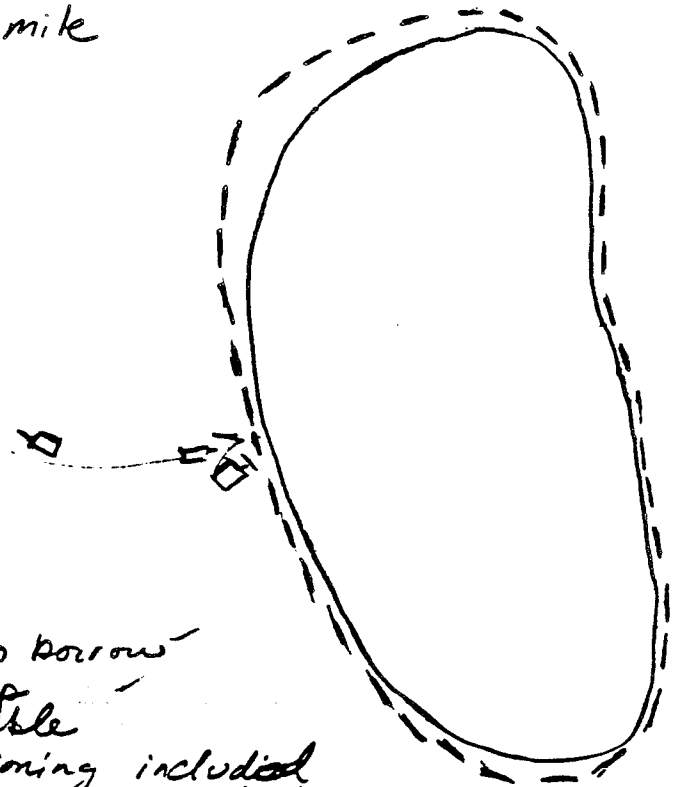
Sheet 2 of 9

IN BORROW ① D8 Dozer - 1 ea excavation
② 245 Backhoe - 2 ea
③ Wheel tractor w/ disc
④ Water tanker
⑤ Dozer - 1 ea support
Receiving stockpile

⑥ Trucks - 8-14



5 mile



Assume - ① Strip 1.0' to get to borrow
② Clay borrow 5' deep
③ 80% borrow useable
④ Moisture conditioning included
⑤ Clay dumped over fence into hot zone

Subject Clay borrow Cost Estimate

Project No. 86C9554D

By D. Hawk Checked By TCH

Task No. 2

File No. 21947

Date 2/13/87 Date 3/12/87

Sheet 3 of 9

EQUIPMENT

TRUCK: Use 6x4/6x2 Diesel Powered Trucks Rear Dump

STRUCK CAPACITY = 12-18 CY HP = 375
MONTHLY RATE = $4130.00 OC/HR = $18.60/HR
OPERATOR = $17.09/HR
1984 ADJUSTMENT RATE = .901 Regional Adjustment = 1.05
SAY 173 HR/MONTH

⇒ 1.05 x .901 x 4130.00 ÷ 173 = 22.58 EQUIPMENT
18.60 OPERATING
17.09 OPERATOR
$58.27/HR w/ OPER.

BACKHOE: USE CAT 245 HOE w/ 3.25CY BUCKET 325 HP

MONTHLY RATE = $19,695.00 OC/HR = $41.30/HR
OPERATOR = $17.03/HR
1984 ADJUSTMENT RATE = .943
⇒ 1.05 x .843 x 19,695.00 ÷ 173 = 100.77 EQUIP
41.30 OPERATING
17.03 OPERATOR
$159.10/HR w/ OPER.

CYCLE TIME

BACKHOE CYCLE TIME = 23 seconds with 3.25 CY BUCKET FROM CAT PERFORMANCE HANDBOOK.

USE 23 SECOND CYCLE TIME WITH 3 CY BUCKET

⇒ LOAD TIME FOR 18 CY STRUCK CAPACITY TRUCK

18 CY / 3 CY x 23 SEC = 138 SEC

138 SEC / 60 SEC/min = 2.3 MINUTES. LOAD TIME

Subject Clay borrow Cost Estimate

By D. Hawk Checked By TEK

Date 2/13/87 Date

Project No. 86C8554P

Task No. 2

File No. 21947

Sheet 4 of 9

TRUCK CYCLE 10 MILE HAUL (5 MILE 1-WAY)

TURN & POSITION	.5	MINUTES
LOAD	2.3	"
TRANSPORT LOAD	10.8	"
TURN & DUMP	1.0	"
TRANSPORT EMPTY	7.1	"
TOTAL CYCLE	21.7	minutes
ADD 1 min MISC. START/STOP TIME EACHWAY	2.0	minutes
	23.7	minutes

LOADED

.8 min	9.2 min.	.8 min
0-30 mph .2 mi	30 mph (net 27 mph w/ 1 minute delay) 4.6 mi	30-0 mph .2 mi

UNLOADED

.5 min	6.1 min	.5 min
0-45 mph .2 mi	45 mph (net 39 mph w/ 1 min delays) 4.6 mi	45-0 mph .2 mi

USE 24 minute cycle time.

WITH 24 minute cycle time and 2.3 minute load time

$24 \div 2.3 = 10.4$

USE 11 trucks

Subject Clay borrow Cost Estimate

By D. Hawk Checked By TEK

Date 2/13/87 Date

Project No. 86C8554P

Task No. 2

File No. 21947

Sheet 5 of 9

CALCULATE UNIT RATE / HOUR AND PRODUCTION RATE

PRODUCTION RATE BASED ON BACKHOE

$$3\ CY/23\ SEC \times 60\ \frac{SEC}{MIN} \times 60\ \frac{MIN}{HR} \times \frac{50}{60}\ (efficiency)$$

$$= 391\ \frac{CY}{HR}\ (LOOSE)$$

COST

1	BACKHOE	@	$159.10/HR	= $159.10
11	TRUCKS	@	$58.27/HR	= $640.97

$800.07/HR

UNIT RATE $800.07/HR ÷ 391 CY/HR = $2.05/CY LOOSE

CONVERT FROM LOOSE TO IN-PLACE AT LANDFILL

$$\$2.05/CY \times \frac{113.3\ pcf}{90\ pcf} = \$2.58/CY\ (COMPACTED)$$

IN-PLACE PRODUCTION = $391 \times \frac{90}{113.3} = 310\ CY/HR$

Subject Clay borrow Cost Estimate

By D. Hawk Checked By TEK

Date 2/16/87 Date

Project No. 8609554P

Task No. 2

File No. 21947

Sheet 6 of 9

ADDITIONAL COSTS

1) STRIP 1.0 FT FROM TOP
2) SUPPORT DOZERS
3) MOISTURE CONDITIONING

1) COST OF STRIPPING

$1.0 \text{ FT} \times 65.6 \text{ ACRE} \times 43{,}560 \frac{\text{SF}}{\text{ACRE}} \div 27 = 105{,}835 \text{ CY.}$

FROM MEANS 2.3-164-0300

COMMON EARTH SCRAPER EXCAVATION WITH 1500 FT. HAUL

UNIT RATE = $1.89/CY

$105{,}835 \times \$1.89/\text{CY} = \$200{,}000$

UNIT RATE = $200{,}000/360{,}000 = \$0.54/\text{CY}$ SAY $0.43/CY.

2) Add 2 dozers for production time (temporary roads)

$24 \frac{\text{min}}{\text{cycle}} \times \frac{\text{cycle-truck}}{18 \text{ CY (load)}} \times \frac{1}{11 \text{ Trucks}} \times 453{,}200 \text{ CY} \times \frac{60}{50}$

$= 65{,}920 \text{ min} \times \frac{\text{HR}}{60 \text{ min}} \times \frac{1 \text{ DAY}}{8 \text{ HR}}$

= 137 work days

FROM BLUE BOOK RENTAL FOR D8L (335 HP)
1984 ADJUSTMENT RATES

See Analysis (1) = $73.67/HR EQUIP.
OPERATING COST = $32.70/HR
OPERATOR = $17.58/HR

$123.25/\text{HR} \times 8 \text{ HR} = \$986.00/\text{DAY}$

Subject Clay Borrow Cost Estimate

Project No. 86C9554P

By D. Hawk Checked By TEK

Task No. 2

File No. 21947

Date 2/16/87 Date

Sheet 7 of 9

D6D FOR SUPPORT 140 HP

1984 ADJUSTMENT .910

EQUIPMENT $1.05 \times 59.20 \times .910 \div 173 = 32.70$

OPERATING COST $= 13.20$

OPERATOR $= 16.88$

$63.28/HR w/ OPER.

$63.28/HR \times 8 HR/DAY = \$506.24/DAY$

FOR D9L & D6D COSTS

$(986.00 + 506.24)/DAY \times 137 DAYS = \$204,000$

Subject Clay borrow Cost Estimate | Project No. 86C9554P
By D. Hunt | Checked By TEK | Task No. 2
Date 2/14/87 | Date | File No. c21947
Sheet 8 of 9

3) PROCESS CLAY FOR MOISTURE CONTENT

USE 1 TRACTOR WITH DISC AND 1 WATER TRUCK

USE 10,000 gal water tanker, off-highway 330HP
1984 RATE ADJUSTMENT = .883
EQUIPMENT .883×15,575[00]×1.05÷173 = $83[47]
OPERATING = $35[55]
OPERATOR = $17[09]
$136[11]/HR w/ OFFS

137 × 8 × $136[11] = $149,000

ASSUME WATER PROVIDED ON-SITE BY RMA

USE 1 wheel tractor w/ disc attachment

USE MRS I-100S 310 HP WHEEL TRACTOR w/disc
1984 RATE ADJUSTMENT
EQUIPMENT .877×$94[05]÷173×1.05 = $50[06]
OPERATING = $30[35]
OPERATOR $16[98]
DISC RENTAL 400[00]×.877×1.05÷173 = $2[13]
OPERATING $0[55]
$99[97]/HR w/OFFS.

137 DAYS × 8 HRS/DAY × $99[97]/HR = $110,000

TOTAL = $110,000 + 149,000 = $259,000

Subject Clay borrow Cost Estimate

By D. Hawk Checked By TEK

Date 2/16/87 Date

Project No. 86C9554P

Task No. 2

File No. 21947

Sheet 9 of 9

TOTAL COST TO EXCAVATE AND PROCESS CLAY

$2.58/CY × 360,000	=	$928,800
ITEM 1	=	200,000
ITEM 2	=	204,000
ITEM 3	=	259,000
		$1,591,800

UNIT RATE

$$\frac{\$1,591,800}{360,000} = \$4.42/CY$$

- Clay - Stockpile to Cap Basin F

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3/18/87

PROJECT	PREPARED BY	CREW REF NO
RMA	T. KELLEY	
LOCATION	**CHECKED BY**	
DENVER, CO	D. HAWK 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION / PLACEMENT		CLAY - STOCKPILE TO CAP BASIN F

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 627B SCRAPER	8	17.03	136.24	117.77	942.16
CAT D8L DOZER	3	16.88	50.64	106.37	319.11
CAT 825C COMPACTOR	1	16.88	16.88	90.52	90.52
10,000 gallon WATER TANKER	1	17.09	17.09	119.02	119.02
CAT 14G MOTOR GRADER	1	17.03	17.03	75.61	75.61
MRS 1-100S TRACTOR W/DISC	1	16.88	16.88	83.09	83.09
LABORERS	3	12.76	38.28	—	—
CAT 627B SCRAPERS (STANDBY)	2	—	—	75.37	150.74
TOTALS — MANHOURS	18	LABOR COST	293.04 ✓	EQUIPMENT COST	1780.25 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR MH/UNIT	LABOR $/UNIT	EQUIPMENT $/UNIT	COMMENTS
EXCAVATION / PLACEMENT	1176 ccy/hr.		$0.25/cy ✓	$1.51/cy	
SAFETY	1176 ccy/hr.		$0.20/cy	0.42/cy	
TOTAL EQUIPMENT, LABOR, SAFETY				→	$2.45/ccy ✓

*Including fringe benefits

DA FORM 5418-R, Apr 85

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	T. KELLEY	
LOCATION	**CHECKED BY**	
DENVER, CO	D. Hawk 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		CLAY- STOCKPILE TO CAD BASIN E

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	15	—	—	38.20	573.00
STANDBY EQUIPMENT	2	—	—	4.45	8.90
LABORERS	3	78.05	234.15	—	—
TOTALS	MANHOURS		LABOR COST	234.15 ✓	EQUIPMENT COST 581.90 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	1176 CCY/hr.		$0.20/cy ✓	$0.49/cy ✓	

*Including fringe benefits

DA FORM 5418-R, Apr 85

Subject EARTHWORK COSTS - BASIN F CONSTRUCTION Project No. 86C8554P

By D. HAWK Checked By T.K Task No. 2

File No. 21947

Date 3/10/87 Date 3/12/87 Sheet 1 of 4

PLACEMENT OF CLAY CAP FOR BASIN F

THE WORK INVOLVED WILL CONSIST OF HAULING CLAY FROM STOCKPILES WITHIN BASIN F TO THE BASIN F AREA FOR CAPPING. THIS WILL BE PERFORMED AS EXCAVATION PROGRESSES TO MINIMIZE AREA OF BASIN F EXPOSED FOR RUNOFF. TWO D8 DOZERS WILL BE USED FOR LOADING SCRAPERS AND ANOTHER TO ASSIST IN SPREADING CLAY OVER BASIN BOTTOM. A CAT 14G MOTOR GRADER WILL BE USED FOR LEVELING AND SPREADING. THE MATERIAL WILL BE DISCED AND MOISTURE CONDITIONED DURING PLACEMENT AND COMPACTED WITH A CAT 825 C COMPACTOR. THREE LABORERS FOR SPOTING AND GRADE CHECKING WILL BE REQUIRED.

THE CLAY STOCKPILE AREA USED FOR LANDFILL CONSTRUCTION WILL BE USED FOR CLAY CAP OVER BASIN F.

ASSUME ALL OF THE WORK PERFORMED IN LEVEL B.

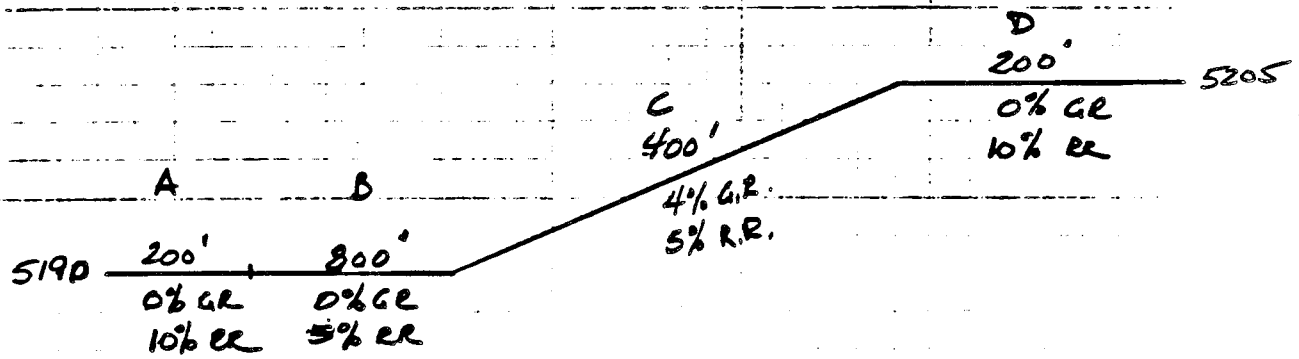
Subject EARTHWORK COSTS - BASIN F CONSTRUCTION | Project No. 86C8554P

By D. HAWK | Checked By TK | Task No. 2

Date 3/10/87 | Date 3/12/87 | File No. 21947

Sheet 2 of 4

AVERAGE HAUL PROFILE - BASED ON EXCAVATION PLAN



ESTIMATE CYCLE TIME (CAT 627B SCRAPERS)

SECTION	LENGTH	LOADED TR	LOADED TIME	UNLOADED TR	UNLOADED TIME
A	200'	10%	.31	10%	.23
B	800'	5%	.65	5%	.50
(25 mph assumed) C	400'	-1%	.18	9%	.38
D	200'	10%	.31	10%	.23
			1.45 min		1.34 min
		w/ 93% Altitude Derating	1.56 min		1.44 min

TOTAL CYCLE TIME

HAUL	= 1.56 min
RETURN	= 1.44 min
LOAD	= .60 min
MANEUVER & DUMP	= .60 min
ADDITIONAL MANEUVER	= .26 min
	4.40 min @ 100% EFF.

Subject EARTHWORK COSTS - BASIN F CONSTRUCTION Project No. 86C8554P

By D. HAWK Checked By TLK Task No. 2

File No. 21947

Date 3/10/87 Date 3/12/87 Sheet 4 of 4

EQUIPMENT LIST AND COSTS

1)	8	CAT 627 B SCRAPERS	@ $134.80	=	$1078.40
2)	3	CAT D8L DOZERS	@ 123.25	=	369.75
3)	1	CAT 825C COMPACTOR	@ 107.40	=	107.40
4)	1	WATER TANKER (10,000 GAL)	@ 136.11	=	136.11
5)	1	CAT 14G MOTOR GRADER	@ 92.64	=	92.64
6)	1	TRACTOR W/ DISC ATTACHMENT	@ 99.97	=	99.97
7)	2	CAT 627 B SCRAPERS (STANDBY)	@ 75.37	=	150.74
8)	3	LADDERS	@ 12.26	=	38.28

$2073.29/HR ✓

UNIT COST OF CLAY PLACEMENT FOR BASIN F CAP

$2073.29/HR ÷ 1176 CY/HR = $1.76/CY * ✓

* NOTE: THIS COST IS WITHOUT SAFETY CONSIDERATIONS EXCEPT PRODUCTION EFFICIENCY OF 45/60.

Subject EARTHWORK COSTS - BASIN F CONSTRUCTION Project No. 86C8554P

By D. Hawk Checked By TCK Task No. 2

Date 3/10/87 Date 3/12/87 File No. 21947

Sheet 3 of 4

ESTIMATE PRODUCTION

1) ESTIMATED LOAD 18 LCY × 0.K. .80 = 14.4 CCY/LOAD ✓

2) CYCLES PER HOUR 60 min/HR ÷ 4.40 min/CYCLE = 13.6 CYCLE/HR. ✓

3) HOURLY PRODUCTION RATE = 14.4 CCY/LOAD × 13.6 LOAD/HR = 196 CCY/HR ✓

4) NEED ONE SCRAPER EVERY 0.6 MINUTES
4.40 min ÷ 0.6 minutes = 7.3 scrapers. Use 8

5) CHECK PUSHER COMBINATION

Pusher Cycle Time = 1.4(.6)+.25 = 1.09 min ✓
Scraper Cycle Time = 4.40 min
⇒ 4.40/1.09 = 4.0 ✓
Each dozer can handle 4.0 scrapers ✓ OK

6) HOURLY FLEET PRODUCTION

8 SCRAPERS × 196 CCY/HR = 1568 CCY/HR ✓

7) ADJUSTED PRODUCTION - (USE 45/60 EFFICIENCY TO ACCOUNT FOR LEVEL B PROTECTION) O.K.

45/60 × 1568 CCY/HR = 1176 CCY/HR ✓

8) CHECK COMPACTION BALANCE 1 CAT 825 C @ 6 mph w/6" lifts, 3 p

PRODUCTION = 1444 CY/HR ✓
ALTITUDE DERATION = .94
EFFICIENCY = 45/60

1444 × .94 × 45/60 = 1018 CY/HR ✓ < 1176 CCY
ASSUME ADDITIONAL COMPACTION FROM SCRAPERS & WATER TANKER ✓ OR O.K.

- Stockpiled Clay to Waste Pile Bottom Clay Liner
- Stockpiled Clay to Waste Pile Berms
- Stockpiled Clay to North Lagoon Liner
- Stockpiled Clay to Leachate Lagoon Liner

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	D. Hawk	
LOCATION	**CHECKED BY**	
Denver, Co	T. Kelley 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
Excavation/Placement		Stockpiled Clay to Landfill Clay Liner

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 627 B Scrapers	9	17.03	153.27	117.77	1059.93
CAT D8L Dozers	3	16.88	50.64	106.37	319.11
CAT 825C Compactor	1	16.88	16.88	90.52	90.52
10,000 gallon Water Tanker	1	17.09	17.09	119.02	119.02
CAT 14 G Motor Grader	1	17.03	17.03	75.61	75.61
MRS 1-100S Tractor w/Disc	1	16.88	16.88	83.09	83.09
Laborers	3	12.76	38.28	—	—
CAT 627 B Scrapers (Standby)	2	—	—	75.37	150.74
TOTALS — MANHOURS	19	LABOR COST	510.07	EQUIPMENT COST	1898.02

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
Excavation/Placement	1050 CY/HR		$0.30/CY	$1.81/CY	
Safety	1050 CY/HR		$0.22/CY	$0.59/CY	
Total Equipment Labor & Safety	—			→	$2.92/CY

* Including fringe benefits

DA FORM 5418-R, Apr 85

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT: RMA

PREPARED BY: D. HAWK

CREW REF NO:

LOCATION: DENVER, CO.

CHECKED BY: T. Kelley 3/18/87

CREW COMPOSITION

WORK TYPE: SAFETY

WORK SCHEDULE:

SPECIAL INFORMATION: STOCKPILED CLAY TO LANDFILL CLAY LINER

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	16			38.20	611.20
STANDBY EQUIPMENT	2			4.45	8.90
LABOR	3	78.05	234.15		
TOTALS / MANHOURS		LABOR COST	234.15	EQUIPMENT COST	620.10

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	1050 CY/HR		$0.22/CY	$0.59/CY	

* Including fringe benefits

DA FORM 5419-R, Apr 85

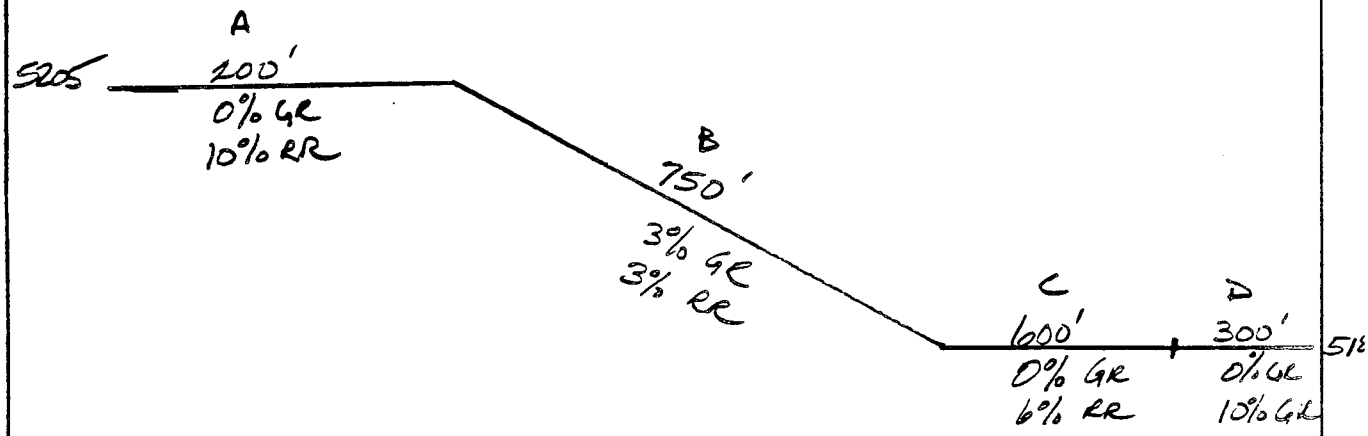
Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS Project No. 86C8554P

By D. HAWK Checked By T. [illegible] Task No. 2

Date 3/6/87 Date 3 [illegible] File No. 21947

Sheet 1 of 5

CLAY TO LANDFILL CLAY LINERS



ESTIMATED CYCLE TIMES

SECTION	LENGTH	LOADED IR	LOADED TIME	UNLOADED IR	UNLOADED TIME
A	200'	10%	.30	10%	.25
B	750'	0%	.45	6%	.50
C	600'	6%	.52	6%	.45
D	300'	10%	.41	10%	.32
	1850'		1.68 ✓		1.52 ✓

1) CAT 627B LOADED @ 1950' = 1.68
2) CAT 627B EMPTY @ 1850' = 1.52
3) LOAD TIME = .60
4) MANEUVER TIME = .60
5) ADDITIONAL MANEUVER (TIGHT STOCKPILE) = .20

4.60 min ✓

@ 93% efficiency (altitude adjustment) = 5.0 min

Need one scraper every 0.6 minutes

5.0 min/cycle ÷ 0.6 minutes = 8.3 scrapers
Use 9 scrapers ✓

Use 2 D8L push CATS for nine scrapers

Check balance

BOOST TIME	=	0.1 min	= .1
RETURN TIME	=	.4 x (.6)	= .24
Maneuver	=	.15	= .15
Load Time	=	.6	= .6

1.09 min/cycle

Scraper Cycle = 5.0 min
Push Cycle = 1.1 min

⇒ Each Push CAT can handle $\frac{5.0}{1.1}$ = 4.5 scrapers ✓

⇒ 2 D8L PUSH CATS CAN HANDLE 9 SCRAPERS ✓

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS Project No. 86C8554P

By D. HANK Checked By Task No. 2

File No. 21947

Date 3/6/87 Date Sheet 3 of 5

PRODUCTION

WITH 9 scrapers hauling @ 18 LCY/LOAD

FROM GEOTECHNICAL INFORMATION

Clay @ 100% COMPACTION ASTM-D-698 = 113.3 pcf
Opt. Mc = 14.6%

SAY 113 pcf & 15% Mc

LOAD FACTOR FOR CLAY = 0.8 ASSUMED

∴ 18 LCY × .8 = 14.4 CY/LOAD

SAY 14 CY/LOAD

CYCLE TIME = 5.0 minutes @ 100% efficiency

$$\text{PRODUCTION} = \frac{60 \text{ min}}{\text{HR}} \div \frac{5 \text{ min}}{\text{cycle}} = 12 \frac{\text{cycles}}{\text{HR/unit}}$$

$$\text{UNIT PRODUCTION} = 14 \frac{\text{CY}}{\text{cycle}} \times 12 \frac{\text{cycles}}{\text{HR}} = 168 \frac{\text{CY}}{\text{HR}}$$

$$\text{ADJUSTED PRODUCTION (45 min. hour)} \quad 168 \frac{\text{CY}}{\text{HR}} \times \frac{45 \text{ min}}{60 \text{ min}} = 126 \frac{\text{CY}}{\text{HR}}$$

$$\text{FLEET PRODUCTION (compacted)} \quad 8.3 \text{ Units} \times 126 \frac{\text{CY}}{\text{HR/UNIT}} = 1050 \frac{\text{CY}}{\text{HR}}$$

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS | Project No. 92855YP

By D. HAWK | Checked By T. F. | Task No. 2

Date 5/7/87 | Date 11/7 | File No. 21947

Sheet 4 of 5

EQUIPMENT LIST

9 CAT 627B SCRAPERS
3 CAT D8L DOZERS
1 CAT 825C COMPACTOR W/ DOZER
1 DIESEL POWERED WATER TANKER (10,000 GALLONS)
1 CAT 14G MOTOR GRADER
2 CAT 627B SCRAPERS (STANDBY)
1 TRACTOR W/ DISC ATTACHMENT
3 LABORERS (SPOTTERS - GRADE CHECK)

NOTE: ALL EQUIPMENT COSTS DETERMINED PREVIOUSLY FOR GENERAL FILL EXCEPT TRACTOR W/ DISC

TRACTOR W/ DISC ATTACHMENT:

USE MRS 1-100S 310 HP

EQUIPMENT $\frac{\$405.00}{MO} \times \frac{MO}{173 (HRS)} \times .877 \times 1.05 = \$1.50.66/HR$

OPERATING $\frac{\$30.35}{HR} = \$30.35/HR$

OPERATOR $\frac{\$16.88}{HR} = \$16.88/HR$

TOTAL $\$97.29/HR$

DISC ATTACHMENT (MEANS 1986)

EQUIPMENT $\frac{\$400.00}{MO} \times \frac{MO}{173 (HRS)} \times .877 \times 1.05 = \$2.13/HR$

OPERATING $\frac{\$.55}{HR} = \$.55/HR$

OPERATOR $0 = 0$

TOTAL $\$2.69/HR$

TOTAL COST TRACTOR W/ DISC = $\$99.97/HR$

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS

Project No. 8603911 YP

By D. HAWK

Checked By T. F.

Task No. 2

File No. 21947

Date 3/7/87

Date 3/11/87

Sheet 5 of 5

CLAY LINER PLACEMENT COSTS / HOUR

9	SCRAPERS	@ $134.80	=	$1213.20
3	DOZERS	@ 123.25	=	369.75
1	COMPACTOR	@ 107.40	=	107.40
1	WATER TANKER	@ 136.11	=	136.11
1	MOTOR GRADER	@ 92.64	=	92.64
3	LABORERS	@ 12.76	=	38.28
2	SCRAPERS STANDBY	@ 75.37	=	150.74
1	TRACTOR w/ DISC	@ 99.97	=	99.97

$2208.09/HR

UNIT COST WITHOUT SAFETY

$2208.09/HR ÷ 1050 CY/HR = $2.10/CY

- Stockpiled Clay to Waste Pile Top and Side Clay Liner

Subject CLAY COVER PLACEMENT

Project No. 86C8554P

By D. HAWK

Checked By TGK

Task No. 2

File No. 21947

Date 3/20/87

Date 7/13/87

Sheet 1 of 1

CLAY COVER PLACEMENT FOR TOP AND SLOPES OF THE WASTE PILE

1) PLACEMENT MUST BE CAREFULLY PERFORMED BECAUSE IT IS ABOVE SYNTHETIC LINERS

2) PLACEMENT WILL BE SIMILAR TO SAND DRAIN PLACEMENT; HOWEVER, A COMPACTOR WILL BE REQUIRED AND MATERIAL COSTS WILL BE SIMILAR TO THAT FOR OTHER CLAY PLACED.

3) FOR CLAY COVER CREW

FROM ACTIVITY (6) (ATTACHED)

a) Labor	=	207.04
b) EQUIPMENT	=	625.40
c) SAFETY ON LABOR	=	234.15
d) SAFETY ON EQUIPMENT	=	386.45

FROM SHEET (1) OF EQUIPMENT COSTS FOR CAT 825 C COMPACTOR

a) Labor	=	16.88
b) EQUIPMENT	=	90.52
c) Safety on Labor	=	—
d) Safety on Equipment	=	38.20
TOTAL COST	=	$1598.64/HR
PRODUCTION (FROM ACTIVITY (6))	=	251 CY/HR

4) COSTS

a) LABOR & EQUIPMENT = 1598.64/251 = $6.36/CY ✓

b) MATERIALS (FROM ACTIVITY (5)) (COST ITEM 3) = $4.42/CY ✓

TOTAL = 10.78/CY ✓

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT: RMA	PREPARED BY: T. KELLEY	CREW REF NO
LOCATION: DENVER, CO	CHECKED BY: D. Hawk 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION/PLACEMENT		SUPPLY AND PLACE SAND DRAINS

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT D8L DOZER	1	16.88	16.88	106.37	106.37
CAT 966D LOADER	1	16.88	16.88	61.10	61.10
12 CUBIC YARD END DUMP TRUCK	4	16.78	67.12	37.30	149.20
CAT D6 DOZER	2	16.88	33.76	46.40	92.80
CAT 14G MOTOR GRADER	1	17.03	17.03	75.61	75.61
10,000 gallon WATER TANKER	1	17.09	17.09	119.02	119.02
LABORERS	3	12.76	38.28	—	—
END DUMP TRUCK (STANDBY)	1	—	—	21.30	21.30
TOTALS — MANHOURS	13	LABOR COST	207.04 ✓	EQUIPMENT COST	625.40 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR MH/UNIT	LABOR $/UNIT	EQUIPMENT $/UNIT	COMMENTS
EXCAVATION/PLACEMENT	251 CY/HR		$0.82/CY ✓	$2.49/CY ✓	
SAFETY	251 CY/HR.		$0.93/CY ✓	$1.54/CY ✓	
MATERIALS DELIVERED TO STOCKPILE				$10.20/CY ✓	
TOTAL EQUIPMENT, MATERIALS, LABOR, SAFETY				→	$15.98/CY ✓

*Including fringe benefits

DA FORM 5418-R, Apr 85

(6A)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-600-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	T. KELLEY	
LOCATION	**CHECKED BY**	
DENVER, CO	D. HAWK 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY / [illegible]		SUPPLY AND PLACE SAND DRAINS

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	10	—	—	38.20	382.00
STANDBY HEAVY EQUIPMENT	1	—	—	4.45	4.45
LABORERS	3	78.05	234.15	—	—
TOTALS	MANHOURS		LABOR COST	234.15	EQUIPMENT COST 386.45

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	251 CY/HR		$0.93/CY	$1.54/CY	

* Including fringe benefits

DA FORM 5419-R, Apr 85

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS Project No. 86C8554P

By D. HAWK Checked By Task No. 2

Date 3/7/87 Date File No. 81947

Sheet 1 of 6

PLACEMENT OF SAND DRAIN SYSTEMS

THE WASHED SAND REQUIRED WILL BE OBTAINED FROM OFF-SITE. THE MATERIALS WILL BE DELIVERED BY THE SUPPLIER TO THE LEVEL B LINE AND DUMPED FROM A RAMP ACROSS TO A SPECIFIED STOCKPILE AREA. THE STOCKPILE AREA WILL BE PREPARED USING CLEAN GENERAL FILL. IT IS ASSUMED THAT 10% OF THE WASHED SAND WILL BE WASTED BECAUSE IT WILL BECOME MIXED WITH FINES IN THE STOCKPILE (PRIMARILY AT THE STOCKPILE BASE)

A DOZER WILL BE REQUIRED TO WORK THE STOCKPILE SO THAT CONTINUAL DUMPING MAY OCCUR. ONCE IN THE BASIN, THE SAND WILL BE LOADED WITH FRONT-END LOADERS INTO TRUCKS AND CARRIED TO THE LANDFILL WHERE IT WILL BE DUMPED AND THEN SPREAD USING DOZERS AND MOTOR GRADERS. COMPACTION WILL BE PERFORMED BY SEVERAL PASSES WITH A TRACKED DOZER AND MOISTURE ADDED WITH A WATER TRUCK. SEVERAL SPOTTERS WILL BE REQUIRED IN THIS OPERATION TO POSITION TRUCKS AND CHECK GRADES.

LIGHT TRUCKS SUCH AS TEN-TWELVE CUBIC YARD TANDEMS WILL BE USED FOR HAULING SAND IN BASIN F BECAUSE THEY WILL BE RUNNING OVER LINER WITH ONLY 1-FOOT OF COVER. POSSIBLY MAY BUILD HAUL ROADS OF GENERAL FILL OUT OVER SAND DRAINAGE BLANKET TO ALLOWS TRUCKS TO GET CLOSE TO DUMPING POINT WITHOUT DAMAGING LINER. HAUL ROAD WOULD PROBABLY BE 1 TO 2 FEET OF GENERAL FILL OVER 1 FOOT DRAIN SAND.

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS

Project No. 86C8554P

By D. HAWK

Checked By

Task No. 2

File No. 21947

Date 3/7/87

Date

Sheet 2 of 6

COST OF SAND DRAIN MATERIAL FROM SUPPLIER

ATTACHED ARE PRICE QUOTES FROM SUPPLIERS FOR WASHED SAND DELIVERED TO RMA

FILTER MATERIAL CDOH CLASS A, B OR C PROBABLY ADEQUATE

PAGE 701 CDOH SPECS 1981

COST OF MATERIALS (DELIVERED)

SUPPLIER	HAUL	TYPE	COST MATERIAL	COST HAUL
MOBILE PREMIX (THORNTON)	—	B	$8/TON	—
	5 mi	C	$4/TON	$1.85/TON
	5 mi	GRAVEL 1½" -	$7.50/TON	$1.85/TON
	15 mi	ROAD BASE 3/4"	$3.25/TON	$5.55/TON
ALBERT FEEI & SONS (HENDERSON)	5 mi	B	$4.25/TON	
	5 mi	C	4.25/TON	
	5 mi	ROAD BED I	6.25/TON	
BEINKMAN WOODWARD CONSTRUCTION (HENDERSON)	5 mi	FILTER SAND	$4.65/TON	
	5 mi	ROAD BASE	3.25/TON	

FROM QUOTED INFORMATION ASSUME MATERIAL AT PLANT WILL COST $4.00/TON

DELIVERY WILL PROBABLY BE FROM WITHIN 6 MILE RADIUS OF RMA AND ASSUME 4 MILE ON-SITE HAUL.

DELIVERY WILL BE ABOUT 10 MILES @ ABOUT $0.20/TON MILE

$\therefore$ $4.00/TON + 10 MILES × 0.20/TON-MILE = $6/TON

USE 3400 lb/cy IN-PLACE

$6/TON × TON/2000# × 3400#/CY = $10.20/CY

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS | Project No. 86C8554P

By D. HAWK | Checked By TCK | Task No. 2

Date 3/7/87 | Date 3/11/87 | File No. 21947

Sheet 3 of 6

A CAT 966 C* LOADER WITH 4.0 CY BUCKET WILL BE USED TO LOAD TRUCKS @ 100% EFF $4 \times 50/60 = 3.3$ CY/LOAD ✓ O.K.

CYCLE TIME FOR LOADER = 0.40 minutes / 3.8 CY

TRUCKS ARE 12 CY TANDEM AXLE END DUMPS

USE 0.2 minutes for first load & .4 minutes thereafter

⇒ 0.2 + 2 × 0.40 minutes = 1.0 min / load (4 CY) O.K.

+ 966 C has no deration factor for altitude @ 5000 ✓

TRUCK CYCLE TIME FOR SHORT HAUL ~ 2000 LF ONE WAY WILL BE ABOUT THE SAME AS SCRAPERS (13 mph) ✓

ADDITIONAL HAUL LENGTH WILL BE REQUIRED FOR TRUCKS AS THEY WILL HAVE TO STAY ON DESIGNATED HAUL ROADS IN LANDFILL TO AVOID DAMAGE TO HDPE LINER.

⇒ ADD 300' TO AVERAGE HAUL FROM STOCKPILE TO LANDFILL WHICH WAS 1700' FOR SCRAPERS

⇒ AVG. HAUL FOR TRUCKS = 2000' ✓

DUE TO GRADES INVOLVED AND SHORT HAUL RESTRICTIONS, RETURN TRIP IS JUST SLIGHTLY FASTER THAN LOADED TRIP - SAY 16 mph AVG.

LOADED HAUL = $2000' \times 1\,hr/13\,mi \times mi/5280\,ft \times 60\,min/hr = 1.75$ ✓

EMPTY = $2000' \times 1\,hr/16\,mi \times mi/5280\,ft \times 60\,min/hr = 1.42$ ✓

EXCHANGE TIME	0.50 ✓
LOAD	1.00 ✓
HAUL LOADED	1.75 ✓
MANEUVER & DUMP	.70 ✓
RETURN	1.42 ✓
	5.37 min
	SAY 5.4 min ✓

EXCHANGE AND LOAD = 1.5 min and with 5.4 min/cycle

We need 5.4/1.5 = 3.6 Use 4 TRUCKS ✓

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS Project No. 86C8554P

By D. HAUKE Checked By TEK Task No. 2

File No. 21947

Date 3/7/87 Date 3/11/87 Sheet 4 of 6

ESTIMATE PRODUCTION

AVG. HAUL = 10 CY LOOSE ✓
LOAD FACTOR SAND = .9 ✓
∴ 10 CY HAULED = 10(.9) = 9 CY IN-PLACE ✓

UNIT PRODUCTION @ 100% EFFICIENCY

$$1 \text{ load}/5.8 \text{ min} \times 9 \frac{\text{CY}}{\text{LOAD}} \times \frac{60 \text{ min}}{\text{HR}} = 93 \text{ CY/HR-UNIT} \checkmark$$

We actually have only 3.6 units hauling in cycle effectively ✓

⇒ PRODUCTION = 3.6 × 93 CY/HR = 335 CY/HR ✓
⇒ PRODUCTION W/ INEFFICIENCY = 45/60 × 335 = 251 CY/HR ✓

EQUIPMENT LIST

1 CAT 08L TO WORK STOCKPILE ✓
1 CAT 966 D TO LOAD @ STOCKPILE ✓
4 12 CY TANDEM AXLE END DUMPS ✓
2 CAT D6 DOZERS TO SPREAD ✓
1 CAT 14G MOTOR GRADER TO LEVEL ✓
1 10,000 GALLON WATER TANKER FOR MOISTURE ✓
1 STANDBY TANDEM AXLE END DUMP ✓
3 LABORS (SPOTTERS & GRADE CHECKERS) ✓

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS | Project No. 8623554F

By D. HAWK | Checked By T * | Task No. 2

Date 3/8/87 | Date 1.1. - | File No. 21947

Sheet 5 of 6

EQUIPMENT & LABOR COSTS

1) *CAT D8L = $123.25/HR

2) CAT 966 D LOADER (200 HP)

EQUIPMENT 7490.00/MO. × MO/173 HRS × .891 × 1.05 = 40.52/HR

OPERATING = 20.60/HR = 20.60/HR

OPERATOR = 16.88 = 16.83/HR

TOTAL = 77.98/HR

3) TANDEM AXLE END DUMP P4 20-B 6×4 W/ BOGIE AXLE (300 HP)

EQUIPMENT 3945.00/MO × MO/173 HRS × .901 × 1.05 = 21.30/HR

OPERATING = 16.00/HR = 16.00/HR

OPERATOR = 16.28/HR = 16.78/HR

TOTAL = 54.09/HR

4) CAT D6 DOZERS (140 HP)

EQUIPMENT $5920.00/MO × 1 MO/173 HRS × .910 × 1.05 = 32.70/HR

OPERATING = 13.20/HR = 13.20/HR

OPERATOR = 16.88/HR = 16.83/HR

TOTAL = $63.28/HR

5) *CAT 14G MOTOR GRADER = $92.64/HR

6) *WATER TANKER (10,000 GALLON CAPACITY) 450 HP = $136.44/HR

7) STANDBY TANDEM AXLE END DUMP = $21.30/HR

8) LABORERS (GROUP 1) = $12.76/HR

* NOTE - COSTS GENERATED IN GENERAL FILL COST CALCULATIONS

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS | Project No. 86C8554P

By D. HAWK | Checked By TEK | Task No. 2

File No. 21947

Date 3/8/87 | Date 3/11/87 | Sheet 6 of 6

TOTAL EQUIPMENT COSTS

1	D8L DOZER	@	$123.25/HR	=	$123.25
1	CAT 966D LOADER	@	$77.28/HR	=	$77.28
4	END DUMPS	@	$54.09/HR	=	$216.22
2	CAT D6 DOZERS	@	$63.28/HR	=	$126.56
1	CAT 14G GRADER	@	$92.64/HR	=	$92.64
1	WATER TANKER	@	$136.11/HR	=	$136.11
1	STANDBY END DUMP	@	$21.30/HR	=	$21.30
3	LABORERS	@	$12.76/HR	=	$38.28

TOTAL = $832.44/HR

COST TO DELIVER SAND, HAUL TO LANDFILL FROM STOCKPILE, SPREAD & PLACE

① MATERIAL DELIVERED TO STOCKPILE = $10.20/CY

② HAUL & PLACE (STOCKPILE TO LANDFILL) = $832.44/HR × HR/251 CY = $3.32/CY

TOTAL = $13.52/CY

NOTE: THIS COST IS WITHOUT SAFETY CONSIDERATIONS FOR ITEM 2, EXCEPT FOR PRODUCTION EFFICIENCY OF 45/60.

- Waste Pile Select Fill

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT: RMA	PREPARED BY: T. KELLEY	CREW REF NO:
LOCATION: DENVER, CO	CHECKED BY: D. HAWK 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION/PLACEMENT		GENERAL FILL - BORROW TO STOCKPILE

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 966D LOADERS	2	16.88	33.76	61.10	122.20
CAT DBL DOZERS	3	16.88	50.64	106.37	319.11
18 CUBIC YARD END DUMP TRUCK	5	17.09	85.45	41.18	205.90
LABORERS	3	12.76	38.28	—	—
18 CUBIC YARD END DUMP (STANDBY)	1	—	—	22.58	22.58
TOTALS — MANHOURS	13	LABOR COST	208.13 ✓	EQUIPMENT COST	669.79 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR MH/UNIT	LABOR $/UNIT	EQUIPMENT $/UNIT	COMMENTS
EXCAVATION/PLACEMENT	548 CCY/HR		$0.38/cy ✓	$1.22/cy ✓	
SAFETY	548 CCY/HR		—	$0.21/cy ✓	
TOTAL EQUIPMENT, LABOR, SAFETY				→ $1.81/cy ✓	

*Including fringe benefits

DA FORM 5419-R, Apr 85

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-600-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT: RMA	PREPARED BY: T. KELLEY	CREW REF NO:
LOCATION: DENVER, CO	CHECKED BY: D. HAWK 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		GENERAL FILL – BORROW TO STOCKPILE

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT (LEVEL D)	8	—	—	4.45	35.60
*HEAVY EQUIPMENT. (LEVEL B)	2	—	—	38.20	76.40
HEAVY EQUIPMENT (STANDBY)	1	—	—	4.45	4.45
*2 CAT D8L DOZERS IN LEVEL B CONDITIONS, ALL OTHER					
HEAVY EQUIPMENT IN LEVEL D.					
TOTALS / MANHOURS		LABOR COST	—	EQUIPMENT COST	116.45 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR MH/UNIT	LABOR $/UNIT	EQUIPMENT $/UNIT	COMMENTS
SAFETY	548 CCY/HR		—	#0.21/CY ✓	

*Including fringe benefits

DA FORM 5415-R, Apr 85

Subject EARTHWORK COSTS - LANDFILL CONSTRUCTION Project No. 86C8554P

By D. HAWK Checked By TEK Task No. 2

File No. 21947

Date 3/11/87 Date 3/12/87 Sheet 1 of 4

GENERAL FILL - BORROW TO STOCKPILE

The work involved in this cost will consist of excavating general fill from nearby stockpile areas (assume 3/4 mile distance) and dumping the material in a stockpile grid inside the level B zone. Because of the transfer of material across the Zone B fence line it is assumed that end dumps would be more practical as scrapers or bottom dumps would have difficulty with this maneuver without crossing the boundary.

Several ramps will be constructed up to the fence line (zone barrier) and haul roads constructed such that the end dumps may turn and dump efficiently. Two dozers will be required to ensure material from the ramp areas and spread it to other parts of the stockpile. Two CAT 966 D loaders with the assistance of a D8L dozer will load trucks in the borrow area. No moisture conditioning will be performed at this time. All work outside of the level B zone will be performed at level D. Three spotters will be required in level D zone

Assume stripping costs will be considered elsewhere. (See D Topsoil)

Subject EARTHWORK COSTS - LANDFILL CONSTRUCTION Project No. 86C8554P

By D. HOWK Checked By T. K Task No. 2

File No. 21947

Date 3/11/87 Date 3/18/87 Sheet 2 of 4

HAUL CYCLE (3/4 mile one-way) Use 4000'

TRUCKS ARE TANDEM AXLE 18 CY CAPACITY

A	B	C	
500'	3000'	500'	LOADED CYCLE
0-25	25 mph	25-0	
500'	3000'	500'	EMPTY CYCLE
0-35	35 mph	35-0	

SECTION	LENGTH	AVG. SPEED LOADED	AVG. SPEED UNLOADED	TRAVEL TIME LOADED	TRAVEL TIME UNLOADED
A	500'	12.5 ✓	17.5 ✓	.45 ✓	.32 ✓
B	3000'	25 ✓	35 ✓	1.36 ✓	.97 ✓
C	500'	12.5 ✓	17.5 ✓	.45 ✓	.32 ✓
				2.26 min ✓	1.61 min ✓

EXAMPLE CALCULATION:

$$500\ ft \times \frac{hr}{12.5\ mi} \times \frac{mi}{5280\ ft} \times \frac{60\ min}{hr} = .45\ min$$

LOAD CYCLE USE 2 CAT 966D IN COMBINATION WITH 1 D8L

CAT 966 D USES 4 CY BUCKET

* DOZER PRODUCTION = 800 CY @ 50 ft. D8 w/s dozer

* NO LOADER DERATION FACTOR FOR ALTITUDE @ 5000'

USE .2 min first pass + .4 min for additional passes

FOR 4 CY BUCKET @ .9 Load factor = 3.6 CY/load ✓

18 CY / 3.6 CY/LOAD = 5 PASSES OF LOADER

.2 + 4(.4) = 1.80 min / LOAD (TRUCK) @ 100% EFF.

* Caterpillar Performance Handbook (Pg. 37)

Subject EARTHWORK COSTS - LANDFILL CONSTRUCTION Project No. 86C8554P

By D. HAWK Checked By TEK Task No. 2

File No. 21947

Date 3/11/87 Date 3/18/87 Sheet 3 of 4

TOTAL TRUCK CYCLE TIME

EXCHANGE TIME	0.50	MINUTES
LOAD (2 LOADERS @ 180 CY)	0.90	
HAUL	2.26	
MANEUVER & DUMP	0.70	
RETURN	1.61	

TOTAL CYCLE = 5.97 minutes @ 100% EFF

EXCHANGE & LOAD = 1.40 MINUTES WITH 5.97 min cycle

⇒ WE NEED 5.97/1.40 = 4.3 TRUCKS USE 5

PRODUCTION BASED ON 4.3 TRUCKS

ESTIMATE PRODUCTION

1) AVG LOAD PER CYCLE = 18 CY LOOSE
LOAD FACTOR = .85

AVG. LOAD = 18 CY × .85 = 15.3 CCY/LOAD

2) CYCLES PER HOUR = 60 min/HR × CYCLE/5.97 min = 10.0 cycles/hr

3) HOURLY PRODUCTION RATE = 15.3 CCY/LOAD × 10.0 LOAD/HR = 153 CCY/HR

4) HOURLY FLEET PRODUCTION = 4.3 TRUCKS × 153 CCY/HR = 658 CCY/HR

5) CHECK DOZER PRODUCTION 1200 × .85 = 1020 CCY/HR > 658 CCY/HR

6) ADJUSTED PRODUCTION @ 50/60 EFF.

658 CCY/HR × 50/60 = 548 CCY/HR

- Waste Pile Select Fill

Subject EARTHWORK COSTS - LANDFILL CONSTRUCTION Project No. 86C8554P

By D. HOWE Checked By TCK Task No. 2

File No. 21947

Date 3/11/87 Date 3/18/87 Sheet 4 of 4

EQUIPMENT LIST AND COSTS+

1)	2 CAT 966 D LOADERS	@	$77.23/HR	=	$155.96 ✓
2)	2 CAT D8L DOZER (LEVEL B)	@	123.75	=	246.50 ✓
3)	1 CAT D8L DOZER	@	123.25	=	123.25 ✓
4)	5 TANDEM AXLE END DUMPS 16CY	@	58.27	=	291.35 ✓
5)	1 TANDEM AXLE STANDBY	@	22.58	=	22.58
6)	3 LABORERS	@	12.26	=	58.28 ✓

TOTAL COST = $877.92/HR

+ ALL EQUIPMENT LEVEL D EXCEPT AS NOTED.

COST TO HAUL GENERAL FILL FROM BORROW TO STOCKPILE

$877.92/HR × HR/548 CCY = $1.60/CY ✓

- Topsoil for Waste Pile

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT: RMA	PREPARED BY: T. KELLEY	CREW REF NO
LOCATION: DENVER, CO	CHECKED BY: D. Hawk 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION/PLACEMENT		SUPPLY AND PLACE SAND DRAINS

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT DBL DOZER	1	16.88	16.88	106.37	106.37
CAT 966D LOADER	1	16.88	16.88	61.10	61.10
12 CUBIC YARD END DUMP TRUCK	4	16.78	67.12	37.30	149.20
CAT D6 DOZER	2	16.88	33.76	46.40	92.80
CAT 14G MOTOR GRADER	1	17.03	17.03	75.61	75.61
10,000 gallon WATER TANKER	1	17.09	17.09	119.02	119.02
LABORERS	3	12.76	38.28	—	—
END DUMP TRUCK (STANDBY)	1	—	—	21.30	21.30
TOTALS — MANHOURS	13	LABOR COST	207.04 ✓	EQUIPMENT COST	625.40 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR MH/UNIT	LABOR $/UNIT	EQUIPMENT $/UNIT	COMMENTS
EXCAVATION/PLACEMENT	251 CY/HR		$0.82/CY ✓	$2.49/CY ✓	
SAFETY	251 CY/HR.		$0.93/CY ✓	$1.54/CY ✓	
MATERIALS DELIVERED TO STOCKPILE				$10.20/CY ✓	
TOTAL EQUIPMENT, LABOR & SAFETY WITHOUT MATERIALS				→	$5.78/CY
TOTAL EQUIPMENT, MATERIALS, LABOR, SAFETY				→	$16.98/CY ✓

*Including fringe benefits

DA FORM 5419-R, Apr 85

(6A)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-600-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT: RMA

PREPARED BY: T. KELLEY

CREW REF NO:

LOCATION: DENVER, CO

CHECKED BY: D. Hawk 3/18/87

CREW COMPOSITION

WORK TYPE: SAFETY / [illegible]

WORK SCHEDULE:

SPECIAL INFORMATION: SUPPLY AND PLACE SAND DRAINS

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	10	—	—	38.20	382.00
STANDBY HEAVY EQUIPMENT	1	—	—	4.45	4.45
LABORERS	3	78.05	234.15	—	—
TOTALS	MANHOURS		LABOR COST	234.15	EQUIPMENT COST 386.45

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	251 CY/HR		0.93/cy	1.54/cy	

*including fringe benefits

DA FORM 5418-R, Apr 85

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS | Project No. B16CB554P
Task No. 2
By D. HAWK | Checked By T. K | File No. 81947
Date 3/7/87 | Date 3/11/87 | Sheet 1 of 6

PLACEMENT OF SAND DRAIN SYSTEMS

THE WASHED SAND REQUIRED WILL BE OBTAINED FROM OFF-SITE. THE MATERIALS WILL BE DELIVERED BY THE SUPPLIER TO THE LEVEL B LINE AND DUMPED FROM A RAMP ACROSS TO A SPECIFIED STOCKPILE AREA. THE STOCKPILE AREA WILL BE PREPARED USING CLEAN GENERAL FILL. IT IS ASSUMED THAT 10% OF THE WASHED SAND WILL BE WASTED BECAUSE IT WILL BECOME MIXED WITH FINES IN THE STOCKPILE (PRIMARILY AT THE STOCKPILE BASE)

A DOZER WILL BE REQUIRED TO WORK THE STOCKPILE SO THAT CONTINUAL DUMPING MAY OCCUR. ONCE IN THE BASIN, THE SAND WILL BE LOADED WITH FRONT-END LOADERS INTO TRUCKS AND CARRIED TO THE LANDFILL WHERE IT WILL BE DUMPED AND THEN SPREAD USING DOZERS AND MOTOR GRADERS. COMPACTION WILL BE PERFORMED BY SEVERAL PASSES WITH A TRACKED DOZER AND MOISTURE ADDED WITH A WATER TRUCK. SEVERAL SPOTTERS WILL BE REQUIRED IN THIS OPERATION TO POSITION TRUCKS AND CHECK GRADES.

LIGHT TRUCKS SUCH AS TEN-TWELVE CUBIC YARD TANDEMS WILL BE USED FOR HAULING SAND IN BASIN F BECAUSE THEY WILL BE RUNNING OVER LINER WITH ONLY 1-FOOT OF COVER. POSSIBLY MAY BUILD HAUL ROADS OF GENERAL FILL OUT OVER SAND DRAINAGE BLANKET TO ALLOWS TRUCKS TO GET CLOSE TO DUMPING POINT WITHOUT DAMAGING LINER. HAUL ROAD WOULD PROBABLY BE 1 TO 2 FEET OF GENERAL FILL OVER 1 FOOT DRAIN SAND.

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS

Project No. 86C8554P

By D. HAWK

Checked By TEK

Task No. 2

File No. 21947

Date 3/7/87

Date 3/11/87

Sheet 2 of 6

COST OF SAND DRAIN MATERIAL FROM SUPPLIER

ATTACHED ARE PRICE QUOTES FROM SUPPLIERS FOR WASHED SAND DELIVERED TO RMA

FILTER MATERIAL CDOH CLASS A, B OR C PROBABLY ADEQUATE PAGE 701 CDOH SPECS 1981

COST OF MATERIALS (DELIVERED)

SUPPLIER	HAUL	TYPE	COST MATERIAL	COST HAUL
MOBILE PREMIX (THORNTON)	—	B	$8/TON	—
	5 mi	C	$4/TON	$1.85/TON
	5 mi	GRAVEL 1½" -	$7.50/TON	$1.85/TON
	16 mi	ROAD BASE 3/4"	$3.25/TON	$5.55/TON
ALBERT FELT & SONS (HENDERSON)	5 mi	B	$4.25/TON	
	5 mi	C	4.25/TON	
	5 mi	ROAD BED I	6.35/TON	
BEINKMAN	5mi	FILTER SAND	$4.45/TON	
WOODWARD CONSTRUCTION (HENDERSON)	5mi	ROAD BASE	5.35/TON	

FROM QUOTED INFORMATION ASSUME MATERIAL AT PLANT WILL COST $4.00/TON

DELIVERY WILL PROBABLY BE FROM WITHIN 6 MILE RADIUS OF RMA AND ASSUME 4 MILE ON-SITE HAUL.

DELIVERY WILL BE ABOUT 10 MILES @ ABOUT $0.20/TON MILE

∴ $4.00/TON + 10 MILES × $0.20/TON-MILE = $6/TON ✓

USE 3400 lb/CY IN-PLACE ✓

$6/TON × TON/2000# × 3400#/CY = $10.20/CY ✓

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS | Project No. 86C855P

By D. HAUK | Checked By TCK | Task No. 2

Date 3/7/87 | Date 3/11/87 | File No. 21947

Sheet 3 of 6

A CAT 966 C* LOADER WITH 4 CY BUCKET WILL BE USED TO LOAD TRUCKS @ 100% EFF 4 x 50/60 = 3.3 CY/LOAD O.K.

CYCLE TIME FOR LOADER = 0.40 minutes / 3.0 CY O.K.

TRUCKS ARE 12 CY TANDEM AXLE END DUMPS

USE 0.2 minutes for first load ; .4 minutes thereafter

⇒ 0.2 + 2 x 0.40 minutes = 1.0 min / load (4 CY)

+966 C has no deration factor for altitude @ 5000' O.K.

TRUCK CYCLE TIME FOR SHORT HAUL ~ 2000 LF ONE WAY WILL BE ABOUT THE SAME AS SCRAPERS (13 mph) ✓

ADDITIONAL HAUL LENGTH WILL BE REQUIRED FOR TRUCKS AS THEY WILL HAVE TO STAY ON DESIGNATED HAUL ROADS IN LANDFILL TO AVOID DAMAGE TO HDPE LINER.

⇒ ADD 300' TO AVERAGE HAUL FROM STOCKPILE TO LANDFILL WHICH WAS 1700' FOR SCRAPERS

⇒ AVG. HAUL FOR TRUCKS = 2000' ✓

DUE TO GRADES INVOLVED AND SHORT HAUL RESTRICTIONS, RETURN TRIP IS JUST SLIGHTLY FASTER THAN LOADED TRIP — SAY 16 mph AVG.

LOADED HAUL = 2000' x 1 HR/13 mi x mi/5280 ft x 60 min/hr = 1.2

EMPTY = 2000' x 1 HR/16 mi x mi/5280 ft x 60 min/hr = 1.42

EXCHANGE TIME	0.50 ✓
LOAD	1.00 ✓
HAUL LOADED ✓	1.75 ✓
MANEUVER & DUMP	.70 ✓
RETURN	1.42 ✓
	5.37 min
	SAY 5.4 min ✓

EXCHANGE AND LOAD = 1.5 min and with 5.4 min/cycle

We need 5.4/1.5 = 3.6 Use 4 TRUCKS ✓

Subject LANDFILL CONSTRUCTION EARTHWORK COSTS Project No. 86C8554P

By D. HAUCK Checked By TEK Task No. 2

Date 3/7/87 Date 3/11/87 File No. 21947

Sheet 4 of 6

ESTIMATE PRODUCTION

AVG. HAUL = 10 CY LOOSE ✓

LOAD FACTOR SAND = .9 ✓

∴ 10 CY HAULED = 10(.9) = 9 CY IN-PLACE ✓

UNIT PRODUCTION @ 100% EFFICIENCY

$$\frac{1 \text{ load}}{5.8 \text{ min}} \times \frac{9 \text{ CY}}{\text{LOAD}} \times \frac{60 \text{ min}}{\text{HR}} = 93 \text{ CY/HR-UNIT} \checkmark$$

We actually have only 3.6 units hauling in cycle effectively ✓

⇒ PRODUCTION = 3.6 × 93 CY/HR = 335 CY/HR ✓

⇒ PRODUCTION W/ INEFFICIENCY = 45/60 × 335 = 251 CY/HR

EQUIPMENT LIST

1 CAT 08L TO WORK STOCKPILE ✓
1 CAT 966 D TO LOAD @ STOCKPILE ✓
4 12 CY TANDEM AXLE END DUMPS ✓
2 CAT D6 DOZERS TO SPREAD ✓
1 CAT 14G MOTOR GRADER TO LEVEL ✓
1 10,000 GALLON WATER TANKER FOR MOISTURE ✓
1 STANDBY TANDEM AXLE END DUMP ✓
3 LOADERS (SCRAPERS & GRADE CHECKERS) ✓

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS | Project No. 86C8554P

By D. HAWK | Checked By TEK | Task No. 2

Date 3/8/87 | Date 3/11/87 | File No. 21947

Sheet 5 of 6

EQUIPMENT & LABOR COSTS

1) *CAT DBL = $123.25/HR ✓

2) CAT 966 D. LOADER (200 HP)

EQUIPMENT 7490.00/MO. × MO/173 HRS × .891 × 1.05 = 40.52/HR ✓

OPERATING = 20.60/HR = 20.60/HR

OPERATOR = 16.88 = 16.88/HR

TOTAL = 77.28/HR ✓

3) TANDEM AXLE END DUMP PA 20-B 6×4 w/ BOGIE AXLE (300 HP)

EQUIPMENT 3895.00/MO × MO/173 HRS × .901 × 1.05 = 21.20/HR ✓

OPERATING = 16.00/HR = 16.00/HR

OPERATOR = 16.78/HR = 16.78/HR

TOTAL = 54.03/HR ✓

4) CAT D6 DOZERS (140 HP)

EQUIPMENT $5920.00/MO × 1 MO/173 HRS × .910 × 1.05 = 32.70/HR ✓

OPERATING = 13.20/HR = 13.20/HR

OPERATOR = 16.88/HR = 16.88/HR

TOTAL = $63.28/HR ✓

5) *CAT 14G MOTOR GRADER = $92.64/HR

6) *WATER TANKER (10,000 GALLON CAPACITY) 450 HP = $13.64/HR

7) STANDBY TANDEM AXLE END DUMP = $21.32/HR

8) LABORERS (GROUP 1) = $12.26/HR

* NOTE - COSTS GENERATED IN GENERAL FILL COST CALCULATIONS

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS | Project No. 86C8554P

By D. HAWK | Checked By TEK | Task No. 2

Date 3/8/87 | Date 3/11/87 | File No. 21947

Sheet 6 of 6

TOTAL EQUIPMENT COSTS

1	D8L DOZER	@	$123.25/HR	=	$123.25
1	CAT 966D LOADER	@	$77.28/HR	=	$77.28
4	END DUMPS	@	$54.09/HR	=	$216.22
2	CAT D6 DOZERS	@	$63.28/HR	=	$126.56
1	CAT 14G GRADER	@	$92.64/HR	=	$92.64
1	WATER TANKER	@	$136.11/HR	=	$136.11
1	STANDBY END DUMP	@	$21.20/HR	=	$21.20
3	LABORERS	@	$12.76/HR	=	$38.28

TOTAL = $832.54/HR

COST TO DELIVER SAND, HAUL TO LANDFILL FROM STOCKPILE, SPREAD & PLACE

① MATERIAL DELIVERED TO STOCKPILE = $10.20/CY

② HAUL & PLACE (STOCKPILE TO LANDFILL) = $832.54/HR × HR/251 CY = $3.32/CY

TOTAL = $13.52/CY

NOTE: THIS COST IS WITHOUT SAFETY CONSIDERATIONS FOR ITEM 2, EXCEPT FOR PRODUCTION EFFICIENCY OF 45/HR.

- 60 mil HDPE Liner
- 12 oz. Geotextile Filter Fabric
- 200 mil HDPE Geonet (Drainage Net)

Subject TOPSOIL

Project No. 86C8554P

By D. HAWK

Checked By Tom Kelly

Task No. 2

File No. 21947

Date 7/7/87

Date 7/13/87

Sheet 1 of 1

TOPSOIL SUMMARY

a) BORROW TO STOCKPILE ACTIVITY (7) $1.60/CY

b) STOCKPILE TO BASIN F ACTIVITY (8) $1.33/CY

$2.93/CY

Woodward-Clyde Consultants

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3/18/87

PROJECT: RMA	PREPARED BY: T. KELLEY	CREW REF NO:
LOCATION: DENVER, CO	CHECKED BY: D. Hawk 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION/PLACEMENT		TOPSOIL BORROW TO STOCKPILE

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 627 B SCRAPER	8	17.03	136.24	117.77	942.16
CAT D6 DOZER	1	16.88	16.88	46.40	46.40
LABORER	1	12.76	12.76	—	—
CAT 627 B SCRAPER (STANDBY)	2	—	—	75.37	150.74
TOTALS — MANHOURS: 10		LABOR COST	165.88	EQUIPMENT COST	1139.80

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
EXCAVATION/PLACEMENT	847 BCY/HR		0.20 ✓	1.34 ✓	
SAFETY	847 BCY/HR		—	0.06 ✓	
TOTAL EQUIPMENT LABOR AND SAFETY					$1.60/BCY ✓

* Including fringe benefits

DA FORM 5419-R, Apr 85

(9A)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3/18/87

PROJECT	PREPARED BY	CREW REF NO
RMA	T. KELLEY	
LOCATION	**CHECKED BY**	
DENVER, CO	D. Hawk 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		TOPSOIL BORROW TO STOCKPILE

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
STAND BY EQUIPMENT	11	—	—	4.45	48.95
TOTALS — MANHOURS		LABOR COST	—	EQUIPMENT COST	48.95 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR MH/UNIT	LABOR $/UNIT	EQUIPMENT $/UNIT	COMMENTS
SAFETY	847 BCY/HR		—	0.06 ✓	ALL EQUIPMENT EXCEPT TRUCKS
					ON STANDBY SAFETY FOR LEVEL D

*including fringe benefits

DA FORM 5418-R, Apr 85

Subject EARTHWORK COSTS - LANDFILL CONSTRUCTION Project No. 86C8554P

By D. HAWK Checked By TEK Task No. 2

Date 3/10/87 Date 3/12/87 File No. 21947

Sheet 1 of 3

TOPSOIL COSTS - BORROW TO STOCKPILE

THE WORK INVOLVED IN THIS COST WILL INVOLVE STRIPPING OF TOPSOIL AND PLACEMENT IN A STOCKPILE NEAR BASIN F. IT IS ASSUMED THAT ALL TOPSOIL USED FOR BOTH THE LANDFILL AND BASIN COVER WILL BE FOUND WITHIN 1 MILE OF BASIN F. SOME, IF NOT ALL OF THIS MATERIAL MAY ORIGINATE FROM THE GENERAL FILL BORROW AREA. IF THE ALTURA CLAY BORROW SOURCE IS 5 MILES AWAY TOPSOIL FROM THIS AREA PROBABLY WON'T BE HAULED TO BASIN F DUE TO THE HAUL LENGTH.

THE CAT 627 B SCRAPERS SHOULD BE WELL SUITED FOR TOPSOIL LOADING WITHOUT DOZER ASSISTANCE. SOME INCREASE IN LOAD TIME AND REDUCTION IN PAY LOAD MAY BE EXPECTED HOWEVER. LOAD REDUCTION WILL BE ACCOUNTED FOR IN LOAD FACTOR (USE 0.70).

ONE CAT D6 DOZER WILL BE USED TO SHAPE STOCKPILE AND AS NEEDED FOR SUPPORT. ONE SPOTTER WILL BE USED AT AREA BEING STRIPPED.

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS Project No. 86C8554P

By D. HAWK Checked By TKL Task No. 2

Date 3/10/87 Date 3/12/87 File No. 21947

Sheet 2 of 3

CYCLE TIME CAT 627 B SCRAPERS

ASSUME AVERAGE HAUL LENGTH < 1 MILE USE 3/4 MILE
ASSUME AVERAGE GRADE RESISTANCE = 5%

HAUL LENGTH = 3/4 (5280) = 3960' USE 4000' ✓

AT 5% TR AND 4000' HAUL AND 93% ALTITUDE DERATION

HAUL TIME	=	2.63 MIN ✓ (2.45 ÷ .93)
RETURN TIME	=	1.88 MIN ✓ (1.75 ÷ .93)
LOAD TIME		.80 MIN O.K.
MANEUVER DUMP	=	.60 MIN O.K.
TOTAL CYCLE TIME		5.91 MIN @ 100% EFF. ✓

ESTIMATE PRODUCTION

1) ESTIMATED LOAD = 18 CY × .70 (L.F.) = 12.6 CY/LOAD ✓

2) CYCLES PER HOUR = $\frac{60 \text{ min}}{\text{HR}} \times \frac{1 \text{ CYCLE}}{5.91 \text{ MIN}} = 10.1 \frac{\text{CYCLES}}{\text{HR.}}$ ✓

3) HOURLY UNIT PRODUCTION = 12.6 BCY × 10.1 $\frac{\text{CYCLES}}{\text{HR}}$ = 127 $\frac{\text{BCY}}{\text{HR}}$ ✓

4) NEED ONE SCRAPER EVERY 0.8 MINUTES
⇒ 5.91 ÷ 0.8 = 7.4 SAY 8 SCRAPERS ✓

5) HOURLY FLEET PRODUCTION

8 SCRAPERS × 127 $\frac{\text{BCY}}{\text{HR-SCRAPER}}$ = 1016 $\frac{\text{CY}}{\text{HR}}$ ✓

6) ADJUSTED PRODUCTION (50 MINUTE HOUR NON-HAZARDOUS)

50/60 × 1016 $\frac{\text{BCY}}{\text{HR}}$ = 847 $\frac{\text{BCY}}{\text{HR}}$ ✓

Subject LANDFILL CONSTRUCTION - EARTHWORK COSTS Project No. 86C8554P

By D. HAWK Checked By TCK Task No. 2

File No. 21947

Date 3/10/87 Date 3/12/87 Sheet 3 of 3

EQUIPMENT LIST & COSTS

1)	8	CAT 627 B SCRAPERS	@	$134.80	=	$1078.40
2)	1	CAT D6 DOZER	@	$63.28	=	$63.28
3)	2	CAT 627 B SCRAPERS (STANDBY)	@	$75.37	=	$150.74
4)	1	LABORER (SPOTTER)	@	$12.76	=	$12.76

$1305.18/HR

COST TO STRIP AND STOCKPILE TOPSOIL NEAR BASIN F

$1305.18/HR × 1 HR/847 BCY = $1.54/BCY

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3/18/87

PROJECT: RMA

PREPARED BY: T. KELLEY

CREW REF NO:

LOCATION: DENVER, CO

CHECKED BY: D. Hawk 3/18/87

CREW COMPOSITION

WORK TYPE: EXCAVATION/PLACEMENT

WORK SCHEDULE:

SPECIAL INFORMATION: TOPSOIL-STOCKPILE TO BASIN F

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 627B SCRAPER	6	17.03	102.18	117.77	706.62
CAT D8L DOZERS	2	16.88	33.76	106.37	212.74
CAT 14G MOTOR GRADER	1	17.03	17.03	75.61	75.61
CAT D6 DOZER	1	16.88	16.88	46.40	46.40
LABORERS	2	12.76	25.52	—	—
CAT 627B SCRAPER (STANDBY)	1	—	—	75.37	75.37
TOTALS — MANHOURS	12	LABOR COST	195.37 ✓	EQUIPMENT COST	1116.74 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
EXCAVATION/PLACEMENT	1020 CCY/hr.		$0.19/CY	$1.09/CY	
SAFETY			—	$0.05/CY	
TOTAL EQUIPMENT, LABOR, AND SAFETY	—			→	$1.33/CCY ✓

*Including fringe benefits

DA FORM 5419-R, Apr 85

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3/18/87

PROJECT	PREPARED BY	CREW REF NO
RMA	T. KELLEY	
LOCATION	**CHECKED BY**	
DENVER, CO	D. HAWK 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		TOPSOIL-STOCKPILE TO BASIN F

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
STANDBY EQUIPMENT	11	—	—	4.35	48.95
TOTALS — MANHOURS		LABOR COST	—	EQUIPMENT COST	48.95 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR MH/UNIT	LABOR $/UNIT	EQUIPMENT $/UNIT	COMMENTS
SAFETY	1,020 ccy/hr.		—	0.05 ✓	ALL EQUIPMENT EXCEPT TRUCKS ON STANDBY SAFETY FOR LEVEL D.

*Including fringe benefits

DA FORM 5418-R, Apr 85

Subject EARTHWORK COSTS - BASIN F CONSTRUCTION Project No. B6C8554P

By D. HAWK Checked By TEK Task No. 2

Date 3/10/87 Date 3/12/87 File No. 21947

Sheet 1 of 4

TOPSOIL COSTS - STOCKPILE TO BASIN F

THE WORK INVOLVED IN THIS COST WILL INVOLVE PICKING UP TOPSOIL FROM A STOCKPILE NEAR BASIN F AND PLACING IT ABOVE THE BASIN AND LANDFILL CLAY CAPS. CAT 627 B SCRAPERS WILL BE USED ASSISTED BY 2 CAT 08L DOZERS AT THE STOCKPILE.

THE TOPSOIL WILL BE TRACKED IN-PLACE WITH A CAT D6 DOZER AND SPREAD AND LEVELED WITH ONE CAT 14G MOTOR GRADER. TWO LABORERS WILL BE REQUIRED FOR SPOTTING AND GRADE CHECKING.

IT IS ASSUMED THAT ALL TOPSOIL PLACEMENT WILL BE PERFORMED AFTER CLAY CAP PLACEMENT UNDER LEVEL D DEGREE OF HAZARD CONDITIONS.

Subject EARTHWORK COSTS - BASIN F CONSTRUCTION Project No. 86C8554P

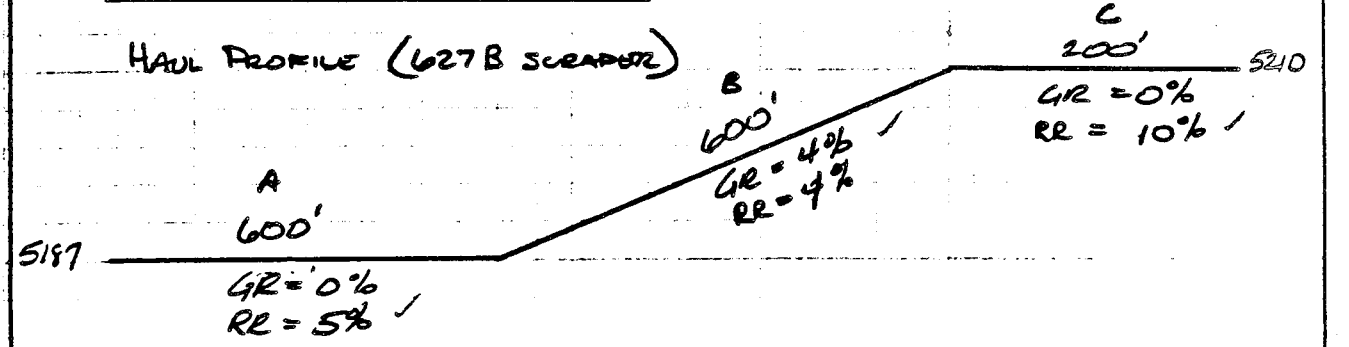
By D. HAWK Checked By TFK Task No. 2

Date 3/10/87 Date 3/12/87 File No. 21947

Sheet 2 of 4

ESTIMATED CYCLE TIMES

HAUL PROFILE (627B SCRAPER)



HAUL CYCLE

SECTION	LENGTH	LOADED TR	LOADED TIME	UNLOADED TR	UNLOADED TIME
A	600'	5%	.50	5%	.41
B	600'	0%	.40	8%	.48
C	200'	10%	.31	10%	.23
		TOTAL TIME	1.21 min		1.12 min
		@ 93% Altitude Deration	1.30 min		1.20 min

TOTAL ESTIMATED CYCLE TIME

HAUL	=	1.30 min
RETURN	=	1.20
LOAD	=	.60
MANEUVER & DUMP	=	.60
		3.70 min/cycle @ 100% EFF.

Subject EARTHWORK COSTS - BASIN F CONSTRUCTION Project No. 86C855YP

By D. HAWK Checked By T&K Task No. 2

File No. 01947

Date 3/10/87 Date 3/12/87 Sheet 3 of 4

ESTIMATED PRODUCTION

1) ESTIMATED LOAD 18 CY x .70 (LOAD FACTOR) = 12.6 CCY/LOAD ✓

2) CYCLES PER HOUR $\frac{60 \text{ MIN}}{\text{HR}} \times \frac{\text{CYCLE}}{3.70 \text{ MIN}} = 16.2 \frac{\text{CYCLES}}{\text{HR}}$ ✓

3) HOURLY UNIT PRODUCTION $12.6 \frac{\text{CY}}{\text{CYCLE}} \times 16.2 \frac{\text{CYCLES}}{\text{HR}} = 204 \frac{\text{CCY}}{\text{HR}}$ ✓

4) NEED 1 SCRAPER EVERY 0.6 MINUTES
⇒ 3.70 ÷ 0.6 = 6.2 SCRAPERS ⇒ USE 6 ✓

5) CHECK PUSH DOZER BALANCE

DOZER CYCLE = 1.4(.6) + .25 = 1.09 MINUTES ✓

$\frac{\text{SCRAPER CYCLE}}{\text{DOZER CYCLE}} = \frac{3.70}{1.09} = 3.4$ SCRAPERS/DOZER ✓

⇒ Each dozer can handle 3+ scrapers ✓ ✓

6) FLEET PRODUCTION @ 100% EFFICIENCY $6 \times 204 \frac{\text{CCY}}{\text{HR}} = 1224 \frac{\text{CCY}}{\text{HR}}$ ✓

7) ADJUSTED PRODUCTION (USE 50 MINUTE HOUR LEVEL D PROTECTION) 50/60 x 1224 CY/HR = 1020 CCY/HR ✓

Subject EARTHWORK COSTS - BASIN F CONSTRUCTION

Project No. 86C0554P

By D. HAWK

Checked By TEK

Task No. 2

File No. 21947

Date 3/10/87

Date 3/12/87

Sheet 4 of 4

EQUIPMENT FLEET & COSTS

6	CAT 627 B SCRAPERS	@ $134.80	=	808.80 ✓
2	CAT D8L DOZERS	@ 123.25	=	246.50 ✓
1	CAT 14G MOTOR GRADER	@ 92.64	=	92.64 ✓
1	CAT D6 DOZER	@ 63.28	=	63.28 ✓
1	CAT 627 B SCRAPER (STANDBY)	@ 75.37	=	75.37 ✓
2	LABORERS	@ 12.76	=	25.52 ✓

TOTAL COST = $1312 ¢/HR ✓

COST TO PLACE TOPSOIL - STOCKPILE TO BASIN F

$1312 ¢/HR × 1 HR/1020 CCY = $1.29/CCY ✓

- Waste Pile Sumps and Piping

RECORD OF VERBAL QUOTE

Project: Name: Basin F

Location: RMA

Quote #: 18-1 (Estimate Sht. No. _____)

Firm: Name: See below

Location: _____

Telephone No.: ( ) _____

Person Talked To: _____

Type of Quote: _____ Supplier, material only (FOB Point: _____)

X Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

Our cost estimate was based upon an independent calculation of the manhours required to install these materials added to the manufacturing cost, and upon telephone estimates from the three leading companies in manufacture/installation of HDPE geomembranes. All costs were based upon installation of synthetic materials under summer conditions and in level B personal protective gear. The cost estimates do not include: construction field and office engineering; independent quality assurance engineering; preparation of subgrade (cut-and-fill, compaction, removal of rocks larger than 1/2-inch); site dewatering; pump station for leachate/leak removal. We also assume that our conceptual design (with a minimum number of penetrations of liner) will be implemented. The estimates are displayed in the accompanying table.

ITEM	ESTIMATED COST ($/LAYER/SF)	ESTIMATED BY	INSTALLATION COMMENTS	
1. 60-mil HDPE Geomembrane	$0.74	HDR	Level B PPE	
	$0.75	Gundle	"	
	$0.80	National Seal	"	use 0.80/
	$0.88	Schlegel	"	
2. 16 oz. PP Geotextile	$0.24	Schlegel	"	
	$0.22	National Seal	"	use 0.25/
3. Drainage Net (Geonet)	$0.32	National Seal	"	
	$0.26	Gundle	"	use 0.25

Date Quote Received: _____

Quote Received By: D. Sprague

FML INSTALLATION COST ESTIMATE

ASSUME: Supplied Air
Protective Clothing
20,000 sq. ft./day

LABOR CLASSIFICATION	DAYS	SALARY	RENTAL	PER DIEM	MOBILIZATION PERSONNEL	MOBILIZATION EQUIPMENT	SAFETY EQUIPMENT	DIRECT + FEE	SALARY + PROFIT	TOTAL
Supervisor (1)	46	$5,497	$0	$2,287	$1,200	$0	$3,430	$7,609	$6,322	$13,931
Head Welder (1)	46	$4,398	$0	$2,287	$1,200	$0	$3,430	$7,609	$5,058	$12,667
Welders (2)	91	$7,916	$0	$4,574	$2,400	$0	$6,861	$15,218	$9,104	$24,322
Technicians (3)	137	$9,895	$0	$6,861	$3,600	$0	$10,291	$22,827	$11,380	$34,207
Qual. Contr. (1)	46	$5,277	$0	$2,287	$1,200	$0	$3,438	$7,609	$6,069	$13,678
Laborers (12)	549	$35,676	$0	$0	$0	$0	$41,164	$45,281	$41,027	$86,308
Operators (1)	46	$0	$0	$0	$0	$0	$3,430	$3,773	$0	$3,773
F. M. Loader (1)	46	$0	$22,869	$0	$0	$1,000	$0	$26,256	$0	$26,256
	1007	$68,659	$22,869	$18,296	$9,600	$1,000	$72,044	$136,182	$78,960	$215,142

$ 0.235 per sq. ft. labor
$ 0.220 per sq. ft. material
$ 0.180 per sq. ft. profit and overhead

SUBTOTAL = $ 0.635 per sq. ft.
$ 0.739 incl. contingency

USE $0.82/SF WHICH INCLUDES SUB O&P BUT NOT CONTRACTOR O&P

× 1.12 O&P

$0.90/SF w/ O&P

- Liquid Removal System

CONSTRUCTION COST ESTIMATE

DATE PREPARED 3-21-87 | SHEET 1 OF 1

PROJECT: RMA

LOCATION: DENVER, CO

ARCHITECT ENGINEER: WCC/HDR

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☒ OTHER (Specify) 60% DESIGN

DRAWING NO.:

ESTIMATOR: D. HAWK

CHECKED BY: Tom Kelly

LANDFILL SUMPS & PIPING SUMMARY

	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
PIPING							
6" PVC	2100	FT	1 44	B 18,144 00 ✓	5 56	11,676 00 ✓	29,820 00
16" PVC	105	FT	3 57	B 224 10 ✓	33 90	3559 50 ✓	5808 60
GRAVEL	6	CY	5 78	B* 34 68 ✓	10 20	61 20 ✓	95 88 ✓
EXCAVATION	6	CY	L.S.	—	—	—	400 00 ✓
						TOTAL	$36,124 48
						SAY	$36,120 00

B INDICATES LEVEL B HAZARD - USE 6× LABOR RATE

B* INDICATES LEVEL B HAZARD - SAFETY INCLUDED

ENG FORM 1 AUG 89 150 PREVIOUS EDITION MAY BE USED

- Sewer and Miscellaneous Debris Removal
- Haul Waste to Solidification

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 7/87 | SHEET: OF

PROJECT: BASIN F

LOCATION: RMA Denver

ARCHITECT ENGINEER: HDR

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☒ OTHER (Specify) 60% Design

DRAWING NO.:

ESTIMATOR: D. A. Kottwitz

CHECKED BY: AL ERICKSON

Sitework SUMMARY Civil	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR (1) TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	Equipment TOTAL COST
Water							
Tap Exist 2" Line	2	EA	10.00	B 120	30.00	60	
Pipe PVC Class 160 2"	315	LF	1.76	B 3,226	0.32	101	
Backflow Preventer thd 2"	2	EA	26.00	B 312	420	840	
Manhole 4'ID x 6' Deep	2	EA	52.00	B 624	320	640	20 - 4
Manhole Top 8" Thk	2	EA	52.00	B 624	82	164	20 - 4
Manhole Covers 24"Ø 300lb	2	EA	48.00	B 576	115	230	18.60 - 3
Screened Stone Bedding For Manholes Compacted ¾"-½"	2	CY	3.72	B 45	16.00	32	0.40 - 1
Excavation for Manholes Using Backhoe 1 CY cap.	41	CY	0.86	B 212		-	1.21 - 5
Back Fill by hand Vib. Plate Compaction 6" Lifts	9	CY	5.22	B 282		-	0.45 -
Trench - Excavation 60" Deep	315	LF	0.24	B 454		-	0.30 -
- Bedding	6	CY	2.68	B 96	5.00	30	0.27 -
- Back Fill Air Tamp	29	CY	3.47	B 604		-	0.78 -
Subtotal				~~7,274~~ 7,173		2,097	2
Process Forcemain							
Pipe - PVC Containment 6"	1,600	LF	-	Included in material total	85.00	136,000	Quote #5
Valves - PVC Ball 4"	1	EA	18.49	B 111	288.00	288	
- Diaphragm - Neoprene Lined 6"	1	EA	160.00	B 960	1,100	1,100	Quote #7
Pipe Supports: Total of 160							
Pipe Clamps Galv. 10"	160	EA	3.45	B 3,312	19.43	3 109	
Galv. Threaded Rod ½"	640	LF	1.28	B 4,916	0.38	243	
Concrete	83	CY			50.90	4225 ~~4,174~~	
Forms - 4 uses	4,480	SFCA	5.10	B 137088	0.85	3 808	0.22 - 96
Concrete Placement	83	CY	4.96	B 2470	0.31	26	0.31 - 2
Subtotal				148,857 ✓		~~49,743~~ 148,799	101

ENG FORM 1 AUG 59 150 — PREVIOUS EDITION MAY BE USED — US GOVERNMENT PRINTING OFFICE

(1) "B" Designates Level B. Labor multiplied by factor of 6.

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 3/87 | SHEET: OF

PROJECT: BASIN F

LOCATION: RMA Denver

ARCHITECT ENGINEER: HDR

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☒ OTHER (Specify) 60% Design

DRAWING NO.: Pump Station

ESTIMATOR: P. A. Kottwitz

CHECKED BY: A C ERICKSON

Structural SUMMARY

	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR (1) TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	Equipment TOTAL COST
Concrete (Div. 3)							
Slabs on Grade:							
Concrete - 4000 psi	11	CY		—	54.20	596	—
Placing	11	CY	7.45	B 492		—	0.96 -
WWF - 6x6 #4/4	5.95	CSF	13.10	B 468	20.20	120	-
Edge Forms	136	LF	1.04	B 849	0.16	22	0.05 -
Screed - 2x4	14	LF	0.69	B 58	0.79	11	0.04 -
Finishing (Broom Finish)	595	SF	0.23	B 821		—	0.04 -
Curing (Sprayed Membrane)	5.95	CSF	2.71	B 97	1.70	10	—
Equipment Pads:							
Concrete - 4000 psi	1	CY			54.20	54	—
WWF - 6x6 #4/4	0.48	CSF	13.10	B 38	20.20	10	—
Placing	1	CY	7.45	B 45		—	1.46 -
Forms	50	LF	1.04	B 312	0.16	8	0.05 -
Finishing (Float Finish)	48	SF	0.22	B 63			0.04 -
Curing (Sprayed Membrane)	0.48	CSF	2.71	B 8	1.70	1	-
Anchor Bolts 5/8" Ø x 12"	8	EA	2.06	B 99	2.20	18	-
1/2" Ø x 6"	12	EA	1.83	B 131 143	0.64	8	-
				~~3,498~~ 3481		858	4
Metals (Div 5)							
Guardrails - Steel	14.5	LF	2.84	247	21.00	305	
- Painting	14.5	LF	0.50	44	0.50	7	
- Anchor Bolts 1/2	20	EA	2.06	247	1.88	35	
- Bolt Layout & Drilling	20	EA	6.30	756	0.05	1	
				1,294		351	
(1) "B" Designates Level B. Labor multiplied by factor of 6.							

CONSTRUCTION COST ESTIMATE

DATE PREPARED	3/87
SHEET	OF
PROJECT	BASIN F
LOCATION	RMA Denver
ARCHITECT ENGINEER	HDR
[redacted]	Pump Station
ESTIMATOR	D.A. Kottwitz
CHECKED BY	AC ERICKSON

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☑ OTHER (Specify) 60% Desi[gn]

Mechanical / Process SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR (M.H.) PER UNIT	LABOR (M.H.) ① TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Air Supply System							
Air Compressor - 330 scfm @ 125 psig	1	EA	24.0	B 144.0	17,800	17,800	Quote =
Air Receiver - 120 gal	1	EA	2.0	B 12.0	842	842	Quote =
Air Piping (- Steel 2"	75	LF	0.15	B 67.5	2.13	160	
threaded } - Steel 3/4"	8	LF	0.10	B 4.8	0.67	5	
Pressure Reducing Valve 2"	1	EA	0.70	B 4.2	260	260	
Ball Valves (- Steel 1/2"	1	EA	0.40	B 2.4	5.05	5	
- Steel 3/4"	1	EA	0.40	B 2.4	8.08	8	
threaded < - Steel 1"	2	EA	0.50	B 6.0	10.44	21	
- Steel 2"	1	EA	3.2	B 19.2	29.84	30	
Pipe Supports - Conc. Block	7	EA	1.0	B 42.0	1.47	9	
- Pipe Clamps	7	EA	0.33	B 13.9	1.32	9	
Air Piping Fittings - 2" Elbows	11	EA	0.83	B 53.7	4.61	51	
- 2" Unions	4	EA	0.94	B 22.6	10.40	42	
- 2"x1" Red.	2	EA	0.76	B 9.1	3.53	7	
- 1" Elbows	2	EA	0.68	B 8.2	1.53	3	
threaded < - 2" Tees	1	EA	1.45	B 8.7	6.25	6	
- 1" Unions	2	EA	0.71	B 8.5	4.91	10	
- 3/4" Flex Conn	2	EA	0.42	B 6.7	23.00	46	
- 3/4" Union	1	EA	0.65	B 3.9	5.85	6	
- 3/4" Elbows	3	EA	0.61	B 11.0	1.25	4	
Pressure Relief Valve 3/4"	2	EA	0.42	B 5.0	19.30	38	
Subtotal				460.8 ✓		19,362 ✓	

① "B" Designates Level B. Labor Multiplied by Factor of 6.

ENG FORM 150, 1 AUG 59 — PREVIOUS EDITION MAY BE USED

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 3/27 | SHEET | OF

PROJECT: BASIN F

LOCATION: RMA Denver

ARCHITECT ENGINEER: HDR

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☑ OTHER (Specify) 60% Desi

DESCRIPTION: Pump Station

ESTIMATOR: D.A. Kottwitz

CHECKED BY: A C ERICKSON

Mechanical / Process SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR (1) TOTAL (MH)	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Fluid Pumping System							
Diaphragm Pumps - 150gpm	2	EA	3.2	B 33.4	8.338	16,676	Quote #
@ 150 FT TDH (P.101 & 201)							
Flex. Connections - Neoprene 3"	4	EA	1.5	B 36.0	259.00	1,036	
Quick Couplings - Stn. Stl. 4"	2	EA	1.6	B 19.2	330.00	660	
Flex Suct. Hose w/ Stn. Stl.	10	EA	1.5	B 90.0	530.45	5305	Quote *
Quick Coupling Ends - 4" ⌀ x 20'							
Pipe - PVC Sch 80 4"	12	LF	0.33	B 23.8	3.60	43	
Fire Containment 6"	20	LF	-	Included in mat'l labor	85.00	1,700	Quote =
Ball Valves - PVC thrd 4"	2	EA	0.92	B 11.0	288.00	576	
Diaphram Valves - Neoprene	1	EA	7.32	B 87.5	1,100	1,100	Quote =
Lined & Neoprene Diaphram Flanged							
Pipe Supports: Total of 2							
Pipe Clamps 10"	2	EA	0.16	B 1.9	19.42	39	
Galv. Threaded Rod ½"	8	LF	0.06	B 2.9	0.38	3	
Concrete	1.04	CY			50.70	53	
Forms - 1 use	56	SFCA	0.30	B 100.8	*1.82	102	* Includes Equip. cost
Concrete Placing	1.04	CY	0.43	B 2.7	*0.49	1	* Equipment
Subtotal				374.2		27,294	
ELECTRICAL							
BRANCH TO COMP PAD	1500	LF	—	—	—	—	15,677
LIGHTING TO COMP. PAD			—	—	—	—	2,842
LABOR							
24hr/day for 25 WD	600	HRS	13.76	8256			8256
(1) "B" Designates Level B. Labor Multiplied by Factor of 6.							

ENG FORM 150
1 AUG 59

PREVIOUS EDITION MAY BE USED

• U.S. GOVERNMENT PRINTING OFFICE

RECORD OF VERBAL QUOTE

Project: Name: BASIN F

Location: DENVER

Quote #: 1 (Estimate Sht. No. _____)

Firm: Name: INGERSOLL-RAND

Location: OMAHA

Telephone No.: (402) 330-5831

Person Talked To: STEVE ZIMMERLE

Type of Quote: X Supplier, material only (FOB Point: DENVER)

_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

MODEL SSR EP 75

w/ • Reduced voltage starting
• Protective shutdown annuciator
• TEFC motor
• Dust inlet

electrical 460V 3ϕ 60HZ

330 cfm Free Air Delivery @ 125 psig

$17,800 ea

Weight = 2350 lb

Date Quote Received: 1/19/87

Quote Received By: FURNE

RECORD OF VERBAL QUOTE

Project: Name: Basin F

Location: RMA Denver

Quote #: 2 (Estimate Sht. No. 1)

Firm: Name: CPI Sales

Location: Omaha

Telephone No.: (402) 334-7317

Person Talked To: Brad Baustead

Type of Quote: X Supplier, material only (FOB Point: Denver)

_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

Air Operated Diaphragm Pumps

Wilden Model M-15

Accessories & Options:

Non Wetted Parts: Cast Iron

Ball Valves: Neoprene

Valve Seats: Neoprene

Diaphragms: Neoprene

Oiler

Filter

Regulator

Polypropylene Surge Supressor

TOTAL COST FOB = $4,165

Weight = 215 lb each

Date Quote Received: 1-19-87

Quote Received By: FURNE

RECORD OF VERBAL QUOTE

Project: Name: BASIN F

Location: DENVER

Quote #: 4 (Estimate Sht. No. _____)

Firm: Name: Ranger Rubber

Location: Omaha, NE

Telephone No.: (402) 551-2300

Person Talked To: John

Type of Quote: X Supplier, material only (FOB Point: _____)

_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

4" Suction Hose w/ 5th. Sth. quick couplings

All chemical type hose

20 ft lengths

Male x Female Couplings

$530.45 each

Date Quote Received: 3-17-87

Quote Received By: D Kathwitz

RECORD OF VERBAL QUOTE

Project: Name: BASIN F

Location: DENVER

Quote #: 5 (Estimate Sht. No. _____)

Firm: Name: Gartner & Assoc. Co. Inc.

Location: Omaha, NE

Telephone No.: (402) 572-6969

Person Talked To: Rene Nelson

Type of Quote: X Supplier, material only (FOB Point: Denver)

_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

INTERGY, INC.

estimate
THIS PROPOSAL FROM
Gartner & Assoc.Co.Inc.
5606 NO. 99th St.
Omaha,No. 68134
(402)572-6969 Rene Nelson

PROPOSAL

DATE 2-20-87

TO WDR INFRASTRUCTURE
8404 Indian Hills Drive
Omaha, No. 68114-4049

NAME OF JOB : Nerve Agent disposal Denver Co.

Attn: Thomas Furne

Per phone conversation 3-19-87, determined that $85/FT is price including installation excluding pipe supports.

Tom, confirming our phone conversation today is a list of some of the specifics for the SAF-T-GARD piping system. I will send additional additional information as I receive. Thank you for your time and consideration. I will be in touch shortly.

SAF-T-GARD CONTAINMENT PIPING SYSTEM:

6" sch40 PVC carrier pipe - solvent welded
10" sch40 PVC containment pipe- PVC welded
2" polyurethane foamed in place insulation
14" final system size with a finished PVC outer casing, common stock couplings

HEAT TRACING:

The piping system shall be electrically heat tape traced. The heat tape and an aluminum wrap to prevent hot spots will be installed in a continuous manner around the containment pipe before the insulation is foamed in place. The electrical connection point will be a Mid Feed System reaching out 1000 feet on either side. Thermostat(s) included. Voltage and breaker size to be clarified. Heat tape to be designed for ambient temperature of 20°F and to maintain fluid at 80°, entering piping system at 55°.

MISCELLANEOUS MATERIAL

Leak detection - sumps with sight glass, drain valve. Spacing as required.
Expansion joints- flanged neoprene type. As required.
Elbows and tee or "T" fittings -factory fabricated.PVC ball valves
Carrier pipe supports -internal to the piping system
Baffles internal to the piping system

PIPING SYSTEM SUPPORTS:

To be field erected by others (Concrete pedistals,"U" straps)

Estimate price to include material,freight to job site, field service instructions $ 85.00 per foot.

Date Quote Received: 2-20-87

Quote Received By: FURNE

RECORD OF VERBAL QUOTE

Project: Name: BASIN F

Location: RMA Denver

Quote #: 6 (Estimate Sht. No. _____)

Firm: Name: INGERSOLL-RAND

Location: OMAHA, NEBRASKA

Telephone No.: (402) 330-5831

Person Talked To: Steve Zimmerle

Type of Quote: X Supplier, material only (FOB Point: Denver)

_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

Model VCG2412 Air Receiver
120 gal
Coast Guard Approved
Epoxy Coated

$842 FOB Denver

Weight -

Date Quote Received: 3-17-87

Quote Received By: D.A. Kottwitz

RECORD OF VERBAL QUOTE

Project: Name: BASIN F

Location: DENVER

Quote #: 7 (Estimate Sht. No. _____)

Firm: Name: Central States Industrial Supply, Inc.

Location: Omaha, NE

Telephone No.: (402) 344-8900

Person Talked To: Keith

Type of Quote: X Supplier, material only (FOB Point: Denver)

_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

6" Saunders Straight Thru Diaphragm Valve with neoprene lining and neoprene diaphragm. Weight = 250 lb.

$1100 FOB Denver

Date Quote Received: 3-18-87

Quote Received By: D A. Kottwitz

- Sewer and Miscellaneous Debris Removal (Compaction in Waste Pile)
- Haul Waste to Waste Pile (Compaction in Waste Pile)

(E)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE

DATE PREPARED: 3-18-87

PROJECT: RMA

PREPARED BY: D. HAWK

CREW REF NO:

LOCATION: DENVER, CO.

CHECKED BY: T. Kelley 3-18-87

CREW COMPOSITION

WORK TYPE: EXCAVATION / HAULING

WORK SCHEDULE:

SPECIAL INFORMATION: SLUDGE HANDLING BASIN F TO SOLIDIFICATION FACILITY

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 627 B SCRAPERS	4	17.03	68.12	117.77	471.08
CAT D8L DOZERS	2	16.88	33.76	106.37	212.74
CAT D6 DOZER	1	16.88	16.88	46.40	46.40
CAT 14 G MOTOR GRADER	1	17.03	17.03	75.61	75.61
MRS 1-100S TRACTOR W/DISC	1	16.88	16.88	83.09	83.09
LABORERS	2	12.76	25.52	—	—
CAT 627 B SCRAPERS (STANDBY)	1	—	—	75.37	75.37
TOTALS — MANHOURS	11	LABOR COST	178.19	EQUIPMENT COST	964.29

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
EXCAVATION/HAULING	404 CY/HR		$0.44/CY	$2.39/CY	
SAFETY	404 CY/HR		$0.39/CY	$0.86/CY	
TOTAL EQUIPMENT, LABOR & SAFETY					→ $4.08/CY

*Including fringe benefits

DA FORM 5418-R, Apr 86

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	D. Hawk	
LOCATION: Denver, Co.	CHECKED BY: T. Kelley 3-18-87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		SLUDGE HANDLING BASIN F TO SOLIDIFICATION FACILITY

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	9	—	—	38.20	343.80
STANDBY HEAVY EQUIPMENT	1	—	—	4.45	4.45
LABORERS	2	78.05	156.10	—	—
TOTALS	MANHOURS		LABOR COST	156.10	EQUIPMENT COST 348.25

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	404 CY/HR		$0.32/CY	$0.86/CY	

* Including fringe benefits

DA FORM 5418-R, Apr 86

Subject Landfill construction - Sludge removal costs. Project No. 86C8554P

By TEK Checked By D. HAWK Task No. 2

File No. 21947

Date 3/16/87 Date 3/18/87 Sheet 1 of 5

SLUDGE HANDLING AND HAULING BASIN F TO SOLIDIFICATION

This work will include mixing and drying sludge, excavating to final grade and hauling to the solidification area.

It is envisioned that Dozers will be used to excavate material down to liner grade and to push load scrapers. Additional dozers will be used to excavate below the liner to the finished grade. Scrapers will be used to haul excavated materials from Basin F to the solidification area rather than trucks as it was assumed they'd be more mobile. It was assumed that portions of the excavation area and sludge could have rolling resistances as high as 15% to 20% whereas other parts of the haul would be on haul roads with very low rolling resistance. Thus, an average rolling resistance of 10% was assumed for the haul.

It was estimated that mixing and drying of the sludge would be achieved by discing with a tractor and disc attachment and a light dozer. A motor grader was envisioned being used for maintaining the haul roads. It was also assumed that 2 laborers would be used as spotters.

Daily production for the excavation fleet should roughly match that of the solidification Pug mill.

Subject Landfill Construction - Sludge-Kimwood Co. Project No. 86C85547

By TEK Checked By D. HAUK Task No. 2

File No. 21947

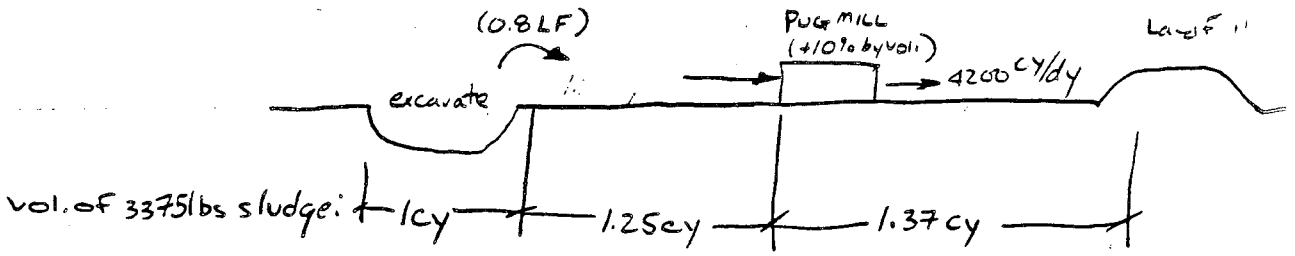
Date 3/16/87 Date 3/18/87 Sheet 2 of 5

REQUIRED PRODUCTION:

IT IS ESTIMATED THAT THE PUG-MILL WILL HAVE A PRODUCTION OF 300 cy/hr. and WILL OPERATE 14 hours a day PRODUCTIVELY,

PUG MILL PRODUCTION = $300\ cy/hr \times 14\ hrs/day = 4,200\ cy/d$

IN TERMS OF BANK CUBIC YARDS:



BCY Production = $4,200\ \frac{cy}{dy}\left(\frac{1bcy}{1.37cy}\right)$

= 3,066 bcy/day ✓

FOR EXCAVATION CREW @ 8 hours per day

$3066\ \frac{bcy}{day}\left(\frac{1\ day}{8\ hours}\right) = \underline{383\ byd^3/hr.}$ ✓

Subject Land Fill Construction - Sludge removal cost Project No. 86C8554P

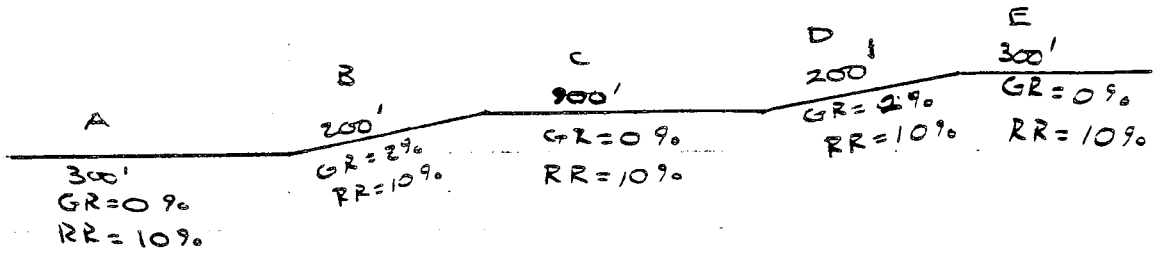
By TEK Checked By D. Hawk Task No. 2

File No. 21947

Date 3/16/87 Date 3/18/87 Sheet 3 of 5

ESTIMATED CYCLE TIMES

HAUL PROFILE (CAT 627B SCRAPER) FROM BOTTOM OF EXCAVATION TO SOLIDIFICATION AREA. ASSUME PROFILE IS ESSENTIALLY THE SAME AS THAT FOR SLUDGE EXCAVATION AND HAULING TO STOCKPILE EXCEPT AVERAGE HAUL IS APPROX. 1600 FT. + 300 FT MANUEVERING = 1900 FT AS SHOWN BELOW.



HAUL LEG	LENGTH	LOADED TR	LOADED TIME	UNLOADED TR	UNLOADED TIME
A	300'	10%	0.39	10%	0.32
B	200'	12%	0.35	8%	0.24
C	900'	10%	1.12	10%	0.76
D	200'	12%	0.35	8%	0.24
E	300'	10%	0.39	10%	0.32
TOTAL TIME			2.60 min. ✓		1.88 min. ✓
@ 93% ALTITUDE DERATION			2.80 min. ✓		2.02 min. ✓

TOTAL ESTIMATED CYCLE TIME

HAUL	2.80 ✓
RETURN	2.02 ✓
LOAD	0.8 ✓
MANUEVER AND DUMP	0.8 ✓

6.42 min/cycle @ 100% eff. ✓

Subject Landfill Construction-Sludge removal Costs | Project No. 96C6554P
Task No. 2
By TEK | Checked By D. HAWK | File No. 2194-7
Date 3/16/87 | Date 3/18/87 | Sheet 4 of 5

ESTIMATED PRODUCTION

1) ESTIMATED LOAD (0.8 ASSUMED LOAD FACTOR)

18 c.y × 0.8 L.F. = 14.4 bcy / LOAD ✓

2) CYCLES PER HOUR

$$\left(60 \text{ min/hr.}\right)\left(\frac{1 \text{ cycle}}{6.42 \text{ min.}}\right) = 9.34 \text{ cycles/hour} \checkmark$$

3) ADJUSTED HOURLY UNIT PRODUCTION (45 min/hr. for level B)

$$\left(\frac{45 \text{ min}}{60 \text{ min}}\right)\left(9.34 \text{ cycles/hr.}\right)\left(14.4 \text{ bcy/LOAD}\right) = 100.9 \text{ bcy/hr.} \checkmark$$

4) NEED 383 bcy/hr.

$$\frac{383 \text{ bcy/hr.}}{100.9 \text{ bcy/unit}} = 3.80 \checkmark$$

Use 4 scrapers ✓

5) CHECK PUSH DOZER BALANCE

DOZER CYCLE 1.4(0.8) + 0.25 = 1.37 minutes ✓

$$\frac{\text{SCRAPER CYCLE}}{\text{DOZER CYCLE}} = \frac{6.42 \text{ min}}{1.37 \text{ min}} = 4.69 \checkmark$$

So use 1 DOZER TO HANDLE 4 SCRAPERS ✓

6) FLEET PRODUCTION @ LEVEL B EFFICIENCY (45 min/hr)

4 × 100.9 bcy/hr. = 403.6 bcy/hr. ✓

Subject Landfill Construction-Sludge Removal Costs Project No. EC CE554P

By TEK Checked By D. HAWK Task No. 2

Date 3/16/87 Date 3/18/87 File No. 21947

Sheet 5 of 5

EQUIPMENT AND FLEET COSTS:

4	CAT 627B SCRAPERS	@ $134.80 =	$ 539.20 ✓
2	CAT D-8L DOZERS	@ $123.25 =	$ 246.50 ✓
1	CAT 627B SCRAPER (STANDBY)	@ $75.37 =	$ 75.37 ✓
1	CAT 14G MOTOR GRADER	@ $92.64 =	$ 92.64 ✓
1	CAT D-6 DOZER	@ $63.28 =	$ 63.28 ✓
1	TRACTOR WITH DISC. ATTACHMENT	$99.97 =	$ 99.97 ✓
2	LABORERS	@ $12.76 =	$ 25.52 ✓
			$1142.48 ✓

COST:

$$\frac{\$\ 1,142.48/HR\ \checkmark}{403.6\ BCY/HR\ \checkmark} = \$\ 2.83/BCY\ \checkmark$$

- Haul Waste to Waste Pile

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	D. HAWK	
LOCATION	**CHECKED BY**	
DENVER, CO.	T. Kelley 3-18-87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
GRADING/COMPACTING		SLUDGE HANDLING GRADE AND COMPACT IN LANDFILL

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 825C COMPACTOR	1	16.88	16.88	90.52	90.52
CAT D8L DOZER	1	16.88	16.88	106.37	106.37
TOTALS — MANHOURS	2	LABOR COST	33.76	EQUIPMENT COST	196.89

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
GRADING/COMPACTION	383 CY/HR		$0.09/CY	$0.51/CY	
SAFETY			—	$0.20/CY	
TOTAL EQUIPMENT, LABOR & SAFETY	—			—	$0.80/CY

* Including fringe benefits

DA FORM 5418-R, Apr 85

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE

DATE PREPARED: 3-18-87

PROJECT: RMA

PREPARED BY: D. Hawk

CREW REF NO:

LOCATION: Denver, Co.

CHECKED BY: T. Kelly 3-18-87

CREW COMPOSITION

WORK TYPE: Safety

WORK SCHEDULE:

SPECIAL INFORMATION:

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
Heavy Equipment	2	—	—	38.20	76.40
TOTALS / MANHOURS		LABOR COST	—	EQUIPMENT COST	76.40

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
Safety	383 cy/hr		—	$0.20/cy	

*Including fringe benefits

DA FORM 5419-R, Apr 85

Subject Landfill Costs - Landfill grading and Compaction

Project No. 86C8554P

By TEK

Checked By D. Hawk

Task No. 2

File No. 21947

Date 3/17/87

Date 3/18/87

Sheet 1 of 2

GRADE AND PLACE WASTE IN LANDFILL

This work will include spreading of the solidified material dumped by the scrapers, and compacting in the landfill.

It is assumed that one dozer will spread the material to grade and a compactor will compact the material with one pass. Two laborers will be used as spotters.

Production should roughly match that of the scrapers hauling the solidified material to the landfill (525 cy./hr. or 383 bcy/hr.)

Subject Landfill costs - Landfill grading and Compaction Project No. 86C8554P

By TEK Checked By D. Hawk Task No. 2

File No. 21947

Date 3/17/87 Date 3/18/87 Sheet 2 of 2

REQUIRED PRODUCTION

hourly prod. = 525 c.y./hr. (383 = bcy/hr.)
scraper cycle = 1.483 min @ 100% efficiency
4 scrapers, 1 scraper every 1.21 min. ✓

CHECK COMPACTOR PRODUCTION:

CAT 825C Performance; 3 passes, 4 mph, 8 inch lifts,
(From CAT Performance Handbook) production = 1283 yd³/hr. ✓ O.K.
1283 × 45/60 = 962 yd³/hr.
So use 1 compactor assisted ✓
by 1 D-8 DOZER

FLEET COST

1 CAT 825C compactor @ $107.40 = $107.40 ✓
1 CAT D-8 DOZER @ $123.25 = $123.25 ✓

$230.65/HR ✓

COST

$230.65/hr. / 525 c.y./hr. = $0.44/c.y. ✓

$230.65/hr. / 430.3 bcy/hr. = $0.60/bcy ✓

*Note: No safety considerations taken into account for this cost except 45/60 % efficiency.

- Solidification

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT: RMA	PREPARED BY: D. HAWK	CREW REF NO:
LOCATION: DENVER, CO.	CHECKED BY: T. KELLY 3-18-87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION / HAULING		SLUDGE HAULING SOLIDIFICATION FACILITY TO LANDFILL

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT 627 B SCRAPERS	4	17.03	68.12	117.27	471.08
CAT D8L DOZERS	1	16.88	16.88	106.37	106.37
CAT 966D LOADERS	2	16.88	33.76	61.10	122.20
LABORERS	2	12.76	25.52	—	—
CAT 627B SCRAPERS (STANDBY)	1	—	—	75.37	75.37
TOTALS — MANHOURS	9	LABOR COST	144.28	EQUIPMENT COST	775.02

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
EXCAVATION / HAULING	383 CY/HR		$0.38/CY	$2.02/CY	
SAFETY	383 CY/HR		$0.41/CY	$0.21/CY	
TOTAL EQUIPMENT WITH LABOR & SAFETY					> $3.52/CY

* Including fringe benefits

DA FORM 5418-R, Apr 85

(13A)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	D. HAWK	
LOCATION: DENVER, Co.	CHECKED BY: T. Kelley 3-18-87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		SLUDGE HANDLING SOLIDIFICATION FACILITY TO LANDFILL

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	7	—	—	38.20	267.40
STANDBY HEAVY EQUIPMENT	1	—	—	4.45	4.45
LABORERS	2	78.05	156.10	—	—
TOTALS	MANHOURS		LABOR COST	156.10	EQUIPMENT COST 271.85

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	383 CY/HR.		$0.41/CY	$0.71/CY	

*Including fringe benefits

DA FORM 5419-R, Apr 85

Subject Landfill Costs - Solidification to Landfill

Project No. 86C3554P

By TEK

Checked By D. Hawk

Task No. 2

File No. 21947

Date 3/16/87

Date 3/18/87

Sheet 1 of 4

SLUDGE HAULING - SOLIDIFICATION AREA TO LANDFILL

This work will include loading material from the solidified sludge stockpile at the Pug mill into scrapers and hauling and dumping it in the landfill.

It is assumed that loaders will be used to top load scrapers. Scrapers will then haul the material to the landfill and dump it. A D-8 dozer will assist the loaders. 2 laborers will be used as spotters

Daily production of the fleet should roughly match the output of the pug mill.

Subject Landfill Costs - Solidification to Landfill | Project No. EECE554P

By TEK | Checked By D. Hawk | Task No. 2

File No. 21947

Date 3/16/87 | Date 3/18/87 | Sheet 2 of 4

REQUIRED PRODUCTION:

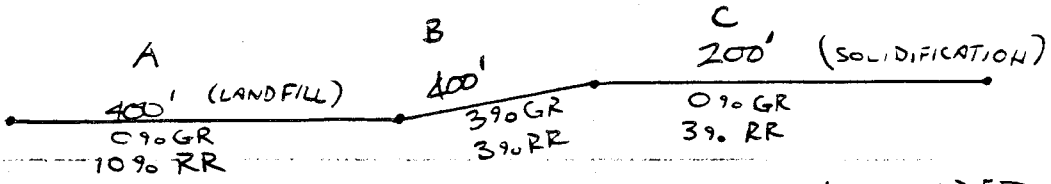
PUG MILL OUTPUT = 4,200 cy/day (3066 bcy/day)

Adjusted Landfill hauling Fleet production for an 8-hour day = 525 cy/hr

(525 ÷ 1.37) = (383 bcy/hr)

ESTIMATED CYCLE TIMES

HAUL PROFILE (CAT 627B SCRAPERS) AVG. HAUL = 800 ft.
USE 1,000ft WITH MANUEVERING



SECTION	LENGTH	LOADED TR	LOADED TIME (min)	UNLOADED TR	UNLOADED TIME (min)
A	400'	10%	.54	10%	.41
B	400'	0%	.34	6%	.34
C	200'	3%	.25	3%	.19
TOTAL TIME			1.13 min. ✓		0.94 min. ✓
@ 93% altitude deration			1.22 min. ✓		1.01 min. ✓

LOAD CYCLE

- USE 0.2 min. first load, 0.4 min. additional loads
- For 4cy bucket @ 1.0 Load factor = 4.0 cy/LOAD
- (18cy. Scraper vol.) ÷ (4.0 cy/load) = 4.5 passes of loader (say
- 0.2 + 4(0.4) = 1.8 min/load @ 100% eff ✓
- (No loader deration for 5000' altitude.) ✓

Subject Landfill Costs - Solidification to Landfill

Project No. 86C8554P

By TEK

Checked By D. Hawk

Task No. 2

File No. 21947

Date 3/16/87

Date 3/18/87

Sheet 3 of 4

TOTAL ESTIMATED CYCLE TIME

HAUL	1.22 min. ✓
RETURN	1.01 min. ✓
LOAD	1.8 min. ✓
MANUEVER & DUMP	0.8 min. ✓

4.83 min/cycle @ 100% eff. ✓

ESTIMATED PRODUCTION:

1) ESTIMATED LOAD (1.0 assumed load factor)

18 cy/load × 1.0 L.F. = 18.0 cy/LOAD ✓

2) cycles per hour

$$\left(60 \text{ min/hr.}\right)\left(\frac{1 \text{ cycle}}{4.83 \text{ m.}}\right) = 12.4 \text{ cycles/hour.}$$ ✓

3) Adjusted Hourly Unit Production (45 min/hr. for level B) ✓

(45 min/60 min)(12.4 cycles/hr)(18.0 cy/load)

= 167.4 cy/hr./unit

4) NEED 525 cy/hr. (LOOSE)

$$\frac{(525 \text{ cy/hr})}{(167.4 \text{ cy/hr/unit})} = 3.14$$ ✓

use 4 scrapers ✓

5) Check loader balance

$$\frac{(\text{Scraper cycle})}{(\text{Loader cycle})} = \frac{4.83 \text{ min}}{1.8 \text{ min}} = 2.68 \frac{\text{scrapers}}{\text{loader}}$$

use 2 Loaders for 4 scrapers ✓

6) FLEET Production @ Level B effiecency (45 min/hr.)

4 × 167.4 cy/hr./unit = 669.6 cy/hr. ✓

$$= \left(\frac{383 \text{ bcy}}{525 \text{ cy}}\right)\left(669.6 \text{ cy/hr}\right) = 488.5 \text{ bcy/hr}$$ ✓

Subject Landfill Costs - Solidification to Landfill

Project No. 86C5549P

By TEK

Checked By D. Hawk

Task No. 2

File No. 21947

Date 3/16/87

Date 3/18/87

Sheet 4 of 4

4	CAT 627B Scrapers @	$134.80	=	$539.20 ✓
1	Cat 627B scraper (standby) @	$75.37	=	$75.37 ✓
2	Cat 966D Loader @	$77.98	=	$155.96 ✓
1	Cat D-8 Dozer @	$123.25	=	$123.25 ✓
2	laborers @	$12.76	=	$25.52 ✓
		TOTAL HOURLY		$919.30 ✓

COST PER CY.

*($919.30/hr.)/(525 CY/hr.) = $1.75/c.y. ✓

*($919.30/hr.)/(383 bcy/hr.) = $2.40/bcy ✓ USE THIS PRICE BASED ON BCY EXCAVATED. THIS WILL INCLUDE 10% ADDITION OF SOLIDIFICATION MATERIAL (VOLUME)

* NOTE: These costs do not include safety consideration costs except for 45/60 % efficiency.

RECEIVED 3/28/87 FROM HDR DJH

CONSTRUCTION COST ESTIMATE

DATE PREPARED 3/87 | SHEET 1 OF 1

PROJECT: BASIN F - EMA

LOCATION: Denver, Co

ARCHITECT ENGINEER: WCC/HDR LABOR 6x on Level B

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☒ OTHER (Specify) 60% Design

DRAWING NO.

ESTIMATOR: KOTTWITZ-GRACHEK

CHECKED BY: A. ERICKSON

Absorption System SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
WOOD WALL							
2x4 Frame	2640	LF	1.68	4436	0.24	634	5070
½" Plywood	2160	SF	1.26	2722	0.41	886	3608
Nails	100	lb	—	—	0.48	48	48
Expension Anchors	60	Ea	11.82	710	2.65	159	869
SITEWORK						SUBTOTAL	9595
2" PVC Water	255	LF	13.00	3,315	8.33	2,124	5,439
Incomming Power	4000	LF	—	75,202	—	103,550	178,75
Sump Excavation	1000	CF	1.98	1,980	0.25	250	2,230
- Concrete	4	CY	437.4	1,750	70	280	2,030
- Formwork	400	SF	23.04	9,216	1.49	596	9,812
EQUIPMENT						SUBTOTAL	198,263
Flu Ash Tanks	2	Ea	24,000	48,000	40,000	80,000	128,00
Pug Mills	3	LS	—	10,000	—	96,000	106,00
- Hoppers	4	Ea	1,200	4,800	2000	8,000	12,80
- Electrical	—	—	—	5856		565	6,421
Belt Conveyors (Fill)	240	LF	100	24,000	750	180,000	204,00
Belt Conveyors (Pilot)	120	LF	100	12,000	600	72,000	84,00
- Electrical	—	—	—	12,700	—	7,300	20,00
Lighting (Abs & Pump St.)		LS		28,098	—	9,004	37,10
Rotary Feeders							
- Feeders, Motor	3	Ea	1,800	5,400	1385	4155	9,555
- VFD 3HP	3	Ea	402	1206	1538	4,614	5,820
Dust Control System							
- Cyclone	1	Ea		5,000		12,000	17,000
- Blower	1	Ea		1560		2,800	4,360
- Electrical	1	Ea		400		800	1,200
						SUBTOTAL	636,25
SUBTOTAL PG 1				258,351		585,765	844,116

CONSTRUCTION COST ESTIMATE

DATE PREPARED 3/87 | SHEET 2 OF 2

PROJECT: BASIN F - Rm A

LOCATION: Denver, Co

ARCHITECT ENGINEER: WCC/HDR

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☒ OTHER (Specify) 60% Design

DRAWING NO.

ESTIMATOR: KOTTWITZ - GRACHEK

CHECKED BY: AL ERICKSON

ABSORPTION AREA SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Ammonia Scrubber System							
- Scrubber	1	Ea		10.000		15,000	25,00
- Pumps, Piping	1	Ea		30880		31,174	62,05
- Blower	1	Ea		1560		4,500	6,06
- Electrical	1	Ea		400		800	1,20C
OPERATIONS						SUBTOTAL	94,31
Chemicals							
- Fly Ash	40.000	CY	—	—	28.70	1,148,000	1,148,
- H_2SO_4	5000	Gal	—	—	0.76	3.800	3,80
- NaClO	400	Gal	—	—	0.90	360	360
- NaOH	500	Gal	—	—	1.02	510	510
						SUBTOTAL	1152,67
Electrical Power	720,000 KWHR	-	4700/mo	SEIMANS CHARGE 28,200	0.06	43,200	71,40
Manpower						SUBTOTAL	71,400
5 Equip Operators	15600	hrs	17.18	268,008	—	—	268,0
2 Laborers	6240	hrs	13.76	85,862	—	—	85.8
1 Pug Mill operator	3120	hrs	16.88	52,666	—	—	52,6
1 Fly Ash operator	3120	hrs	16.88	52,666	—	—	52,66
Equipment						SUBTOTAL	459,20
4 Loaders 130HP	5320	hrs	—	—	61.10	508,352	508,35
1 Dozer 410 HP	2080	hrs	—	—	46.40	96,512	96,51
CAP OUTLAY COST	1	LS	—	—	—	66,000	66,00
Abs. Maint Cost	1	LS	—	—	—	67,500	67,50
CONIC SLAB	1	LS		329,422	LS	SUBTOTAL 83,816	413,23
SUBTOTAL PG 2				859,664		2,069,524	2,929,18
SUBTOTAL PG 1				258,351		585,765	844,116
TOTAL				1,118,015		2,655,289	3,773,30

ENG FORM 1 AUG 39 150

PREVIOUS EDITION MAY BE USED

CONSTRUCTION COST ESTIMATE

DATE PREPARED 3/87 | SHEET 1 OF 2

PROJECT: RMA

LOCATION: DENVER, CO

ARCHITECT ENGINEER: WCC / HDR

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design) 60% DE
- ☒ OTHER (Specify) AL FRICK

DRAWING NO.

ESTIMATOR: FURNE

CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT		LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
GROUND SLAB								
125' x 100' x 8" 0.75	12.500	SF	$0.46	B	34.500	1.44	18 000	52,50
Rebar								
#4's - [(84" x 125' x 0.668 lb/ft) + (67 x 100' x 0.668 lb/ft)] / 2000 lb/Ton = 5.74 T	5.74	Ton	305	B	10.504	505	2,899	13,40
Fill								
(3' Hi x [125' + 100 + 100] x 0.67) / 45 = 24.19 CY	24.2	CY	99	B	14 375	75	1815	16,190
#5's 5 x 3.5' x 1.043 lb/ft / 2000 lb	0.59	Ton	230	B	814	505	298	1112
#4's 3 x 32.5' x 0.668 lb/ft / 2000 lb	0.33	Ton	230	B	455	505	167	622
Equip Pad								
100' x 100' x 4"	10.000	SF	0.43	B	25 700	0.71	7,100	32,90
Rebar WWF - 6" x 6" #4/6	125	CSF	13.10	B	9 825	20.20	2,525	12,35
Structure Slab								
125 x 125 x 19/12	15,625	SF	0.49	B	45 932	1.80	28,125	74,06
#4's (= (84 x 125 x 0.668 lb/ft) / 2000	7.01	Ton	305	B	12,828	505	3,540	16,36
Wall (125 x 5 x 19/12) / 27 = 19.3	19.3	CY	99	B	11,464	75	1,448	12,9
#3 x 125 x 0.668 / 2000) +								
(125 x 3.5 x 0.668 / 2000) = 0.54T	0.54	Ton	230	B	745	505	273	1,018
Finishing								
(125 x 125) + (125 x 100) + (125 x 100) =	40,625	SF	0.22	B	53,625			53,62
Curing 40,625/100	406	CSF	2.71	B	6,602	1.70	690	7,29

CONSTRUCTION COST ESTIMATE

DATE PREPARED 3/87 | SHEET 1 OF 2

PROJECT: RMA

LOCATION: Denver, Co

ARCHITECT ENGINEER: WCC/HDR

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☒ OTHER (Specify) 60% Design; AL Edition

DRAWING NO.

ESTIMATOR: FURNE

CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR	TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Conc. Curb 125' long	125	LF	3.51	B	2,633	2.90	363	2,996
Footings Concrete	148	CY	28	B	24,864	68	10,064	34,928
Rebar	6.25	Ton	330	B	12,375	500	3,125	15,500
Forms Edge	900	LF	1.04	B	5,616	0.16	144	5,760
Footing "	800	SFCA	1.27	B	6,096	0.31	248	6,344
Waffle								
2(125×5) + 2(125×3)	2000	SFCA	4.07	B	48,240	1.20	2,400	51,240
Excavation	940	CY	0.27	B	1,523	0.63	592	2,115
					329,422		83,816	413,238

ENG FORM 150
1 AUG 39

PREVIOUS EDITION MAY BE USED

*U.S. GOVERNMENT PRINTING OFFICE

- Haul Roads (Level B)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3/18/87

PROJECT: RMA	PREPARED BY: T. KELLEY	CREW REF NO:
LOCATION: DENVER, CO	CHECKED BY: D. HAUK 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION/PLACEMENT		HAUL ROADS - LEVEL B AREAS

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT D-8 DOZER	2	16 88	33 76	106 37	212 74
CAT 966 LOADER	1	16 88	16 88	61 10	61 10
18 CUBIC YARD END DUMP TRUCK	3	17 09	51 27	41 18	123 54
CAT 14G MOTOR GRADER	1	17 03	17 03	75 61	75 61
LABORERS	2	12 76	25 52	—	—
TOTALS — MANHOURS	9	LABOR COST	144 46 ✓	EQUIPMENT COST	472 99 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
EXCAVATION/PLACEMENT	317 CCY/hr.		$0 46/cy ✓	$1 49/cy ✓	
SAFETY	317 CCY/hr.		$0 49/cy	$0 84/cy ✓	
MATERIALS DELIVERED TO STOCKPILE	—		—	$8 05/cy ✓	
TOTAL EQUIPMENT MATERIALS, LABOR, SAFETY				→	$11 33/CCY ✓

*Including fringe benefits

DA FORM 5418-R, Apr 85

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	T. KELLEY	
LOCATION	**CHECKED BY**	
DENVER, CO	D. Hawk 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		HAUL ROADS - LEVEL B AREAS

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	7	—	—	38.20	267.40
LABORERS	2	78.05	156.10	—	—
TOTALS	MANHOURS		LABOR COST	156.10 ✓	EQUIPMENT COST 267.40 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	317 CCY/hr.		$0.49/CY ✓	$0.84/CY ✓	

*Including fringe benefits

DA FORM 5418-R, Apr 85

Subject Land fill Construction - Level B haul Road Cost Project No. 86C8554 P

By TEK Checked By D. HAWK Task No. 2

File No. 21947

Date 3/17/87 Date 5/18/87 Sheet 1 of 5

HAUL ROADS , LEVEL B AREAS

THIS WORK will include supplying and transporting haul road material to a stockpile just inside the level B zone, maintaining the stockpile in the level B area, and hauling and placing the material in the level B area.

Several ramps will be constructed up to the fence line (zone B boundary) and haul roads constructed such that end dumps can turn and dump efficiently. A dozer will be required to move material from the ramp area to other parts of the stockpile. A cat 966 loader with the assistance of a D-8 dozer will load trucks in the stockpile area. The loaded trucks will then haul the material an assumed average distance of 1500 ft. and dump the material, where it will be spread by a D-8 Dozer. Two laborers will be used as spotters. A motor grader will be used to maintain the haul roads.

Subject Landfill Construction - Kent Black Hills Project No. 86C8547

By TEK Checked By D. Hawk Task No. 2

Date 3/17/87 Date 3/18/87 File No. 21947

Sheet 2 of 5

MATERIAL COST TO STOCKPILE:

SUPPLIER	MAT'L	COST	HAULING	TOTAL
BRUKMAN - WOODWARD CONSTRUCTION CO.	3/8" max. size Pit Run Gravel	$3.00/TON	$1.85/TON (FOR 10 mile Haul)	$4.85/TON ✓

COST PER CCY

$$\left(\$4.85/\text{TON}\right)\left(\frac{1\ \text{TON}}{2000\ \text{lbs}}\right)\left(\frac{123\ \text{lbs}}{\text{CCF}}\right)\left(\frac{27\ \text{f}^3}{1\ \text{yd}^3}\right) = \$8.05/\text{ccy}\ \checkmark$$

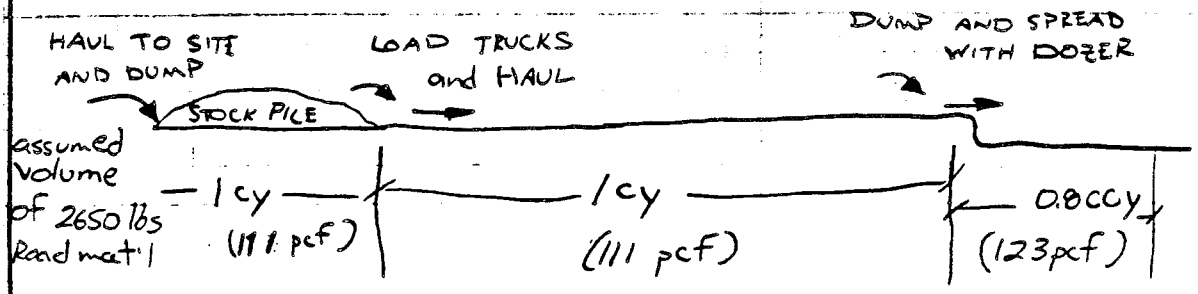
Subject Landfill Construction - Level B haul cost Project No. 86C8554P

By TEK Checked By D. Hawk Task No. 2

File No. 21947

Date 3/17/87 Date 3/18/87 Sheet 3 of 5

ASSUMED LOAD FACTORS



LOAD FACTOR FOR LOADING AND HAULING
= 1 cy / 0.9 ccy ✓

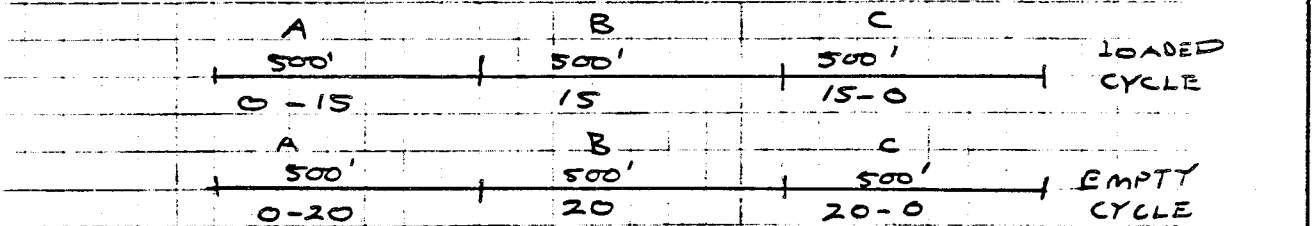
LOAD CYCLE

- USE 0.2 min. for first pass and 0.4 min for additional passes
- FOR 4 cy BUCKET @ 90 % EFF. = 3.6 cy/LOAD (LOOSE) ✓

18 cy Truck / 3.6 cy/LOAD = 5 LOADS ✓

0.2 + 4 (0.4) = 1.8 min to load truck with assistance of one D-8 dozer ✓

HAUL CYCLE



SECTION	LENGTH	Avg speed LOADED	Avg speed EMPTY	TRAVEL TIME LOADED	TRAVEL TIME EMPTY
A	500'	7.5	10	0.76 ✓	0.57 ✓
B	500'	15	20	0.38 ✓	0.28 ✓
C	500'	7.5	10	0.76 ✓	0.57 ✓
				1.90	1.42

$$\text{TIME} = \frac{500\ \text{ft}}{(5280\ \text{ft})\ 1\ \text{mi}} \left(\frac{60\ \text{min}}{\text{hr}}\right)\left(\frac{1}{\text{speed mi/hr.}}\right) = \frac{5.68}{\text{speed (mi/hr.)}}\ (\text{min})$$

Subject Landfill Construction - Level B Liner Road Cut Project No. 86C8554P

By TEK Checked By D. Hauck Task No. 2

File No. 21947

Date 3/17/87 Date 3/18/87 Sheet 4 of 5

TOTAL TRUCK CYCLE

EXCHANGE TIME	0.5 minutes ✓
LOAD	1.8 minutes ✓
HAUL	1.9 minutes ✓
RETURN	1.42 minutes ✓
MANUEVER & DUMP	0.7 minutes ✓

TOTAL CYCLE 6.32 minutes @ 100% eff. ✓

NO. OF TRUCKS

EXCHANGE & LOAD CYCLE

= 1.8 min + 0.5 = 2.3 min ✓

NEED

6.32 min / 2.3 min = 2.75 TRUCKS ✓

USE 3 Trucks ✓

production based on 2.75 trucks ✓

ESTIMATE PRODUCTION

1) AVG LOAD / CYCLE / UNIT

= 18 CY/UNIT LOAD × 0.9 L.F. = 16.2 CCY/UNIT LOAD ✓

2) CYCLES PER HOUR $\left(\frac{60 \text{ min}}{\text{hr.}}\right)\left(\frac{1 \text{ cycle}}{6.32 \text{ min}}\right) = 9.49 \text{ cycles/hr.}$ ✓

3) HOURLY PRODUCTION RATE

$\left(16.2 \text{ CCY/load}\right)\left(\frac{9.49 \text{ load/unit}}{\text{hr}}\right) = 153.7 \frac{\text{CCY}}{\text{unit-hr}}$ ✓

4) FLEET PRODUCTION

2.75 units (153.7 CCY/unit-hr.) = 423 $\frac{\text{CCY}}{\text{hr.}}$ ✓

5) CHECK DOZER PRODUCTION

1200 CY/hr × 0.9 CCY/CY = 1080 CCY/hr. > 423 $\frac{\text{CCY}}{\text{hr}}$ ✓

Subject Landfill Construction - Level B haul road Cost Project No. 86C8554P

By TEK Checked By D. HAWK Task No. 2

File No. 21947

Date 3/17/87 Date 3/18/87 Sheet 5 of 5

6) PRODUCTION ADJUSTED FOR EFFICIENCY (45 min/60 min/hr)

(423 CCY/hr)(45 min/60 min) = 317 CCY/hr. ✓

EQUIPMENT LIST AND COSTS

1)	2 CAT D-8 DOZERS	@ 123.25	= $246.50 /HR.	✓
2)	1 CAT 966 LOADER	@ 77.98	= 77.98	✓
3)	3 18 CY END DUMP TRUCKS	@ 58.27	= 174.81	✓
4)	2 LABORERS	@ 12.76	= 25.52	✓
5)	1 CAT 14G MOTOR GRADER	@ 92.64	= 92.64	
	TOTAL COST		$617.45 /HR	✓

COST TO HAUL FROM STOCKPILE AND PLACE

$\$ 617.45/HR \div 317 \text{ CCY/HR} = \$1.95/\text{CCY}$ ✓

TOTAL COST FOR SUPPLYING AND PLACING

$ 1.95/CCY ✓

+$ 8.05/CCY ✓

$ 10.00/CCY * ✓

* COST W/O SAFETY EXCEPT 45/60 EFFICIENCY

- Haul Roads (Level D)

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-600-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	T. KELLEY	
LOCATION	**CHECKED BY**	
DENVER, CO	D. HAWK 3/19/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
EXCAVATION/PLACEMENT		HAUL ROADS - LEVEL D AREAS

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
CAT D-8L DOZER	2	16.88	33.76	106.37	212.74
CAT 966 LOADER	1	16.88	16.88	61.10	61.10
18 CUBIC YARD END DUMP TRUCK	3	17.09	51.27	41.18	123.54
CAT 14 G MOTOR GRADER	1.	17.03	17.03	75.61	75.61
LABORER	2	12.76	25.52	—	—
TOTALS — MANHOURS	9	LABOR COST	144.46 ✓	EQUIPMENT COST	472.99 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
EXCAVATION/PLACEMENT	352 ccy/hr.	—	$0.41/cy ✓	$1.37/cy ✓	
SAFETY	352 ccy/hr.		—	$0.09/cy ✓	
MATERIALS DELIVERED TO STOCKPILE				$8.05/cy ✓	
TOTAL EQUIPMENT, MATERIALS, LABOR, SAFETY					→ $9.89/cy ✓

*including fringe benefits

DA FORM 5418-R, Apr 85

(16

CREW AND PRODUCTIVITY WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87

PROJECT	PREPARED BY	CREW REF NO
RMA	T. KELLEY	
LOCATION	**CHECKED BY**	
DENVER, CO	D. HAWK 3/18/87	

CREW COMPOSITION

WORK TYPE	WORK SCHEDULE	SPECIAL INFORMATION
SAFETY		HAUL ROADS - LEVEL D AREAS

CREW DESCRIPTION	NO. REQUIRED IN CREW	LABOR COST		EQUIPMENT COST	
		HOURLY* RATE ($/HR)	TOTAL FOR CREW ($/HR)	HOURLY RATE ($/HR)	TOTAL FOR CREW ($/HR)
HEAVY EQUIPMENT	7	—	—	4.45	31.15
TOTALS	MANHOURS		LABOR COST	—	EQUIPMENT COST	31.15 ✓

CREW PRODUCTIVITY

WORK TASK	PRODUCTIVITY RATE UNIT/HR	LABOR		EQUIPMENT $/UNIT	COMMENTS
		MH/UNIT	$/UNIT		
SAFETY	352 CY/HR		—	$0.09/CY ✓	

*Including fringe benefits

DA FORM 5419-R, Apr 85

Subject Landfill Construction - Level D Haul Roads Project No. 8608554 P

By TCK Checked By D. Hawk Task No. 2

File No. 21947

Date 3/17/87 Date 3/18/87 Sheet 1 of 4

HAUL ROADS, LEVEL D AREAS

This work will include supplying and transporting haul road material to the site. O. J and stockpiling the material near the landfill site, but outside of the level D area; maintaining the stockpile, and hauling and placing the material in the level D areas.

It is assumed that a dozer will be required to maintain the stockpile. A cat 966 loader with the assistance of a D-8 dozer will load trucks in the stockpile area. The loaded trucks will then haul the material an assumed distance of 1,500 ft. and dump the material, where it will be spread by a D-8 Dozer. Two laborers will be used as spotters.

Subject Landfill Construction - Level D Haul Roads Project No. E6C8554P

By T. Kelley Checked By D. Hawk Task No. 2

Date 3/17/87 Date 3/18/87 File No. 21947

Sheet 2 of 4

Material Costs to Stockpile

(See level B haul roads)

mat'l	hauling	
$3.00/ton	$1.85/ton	= $4.85/ton ✓

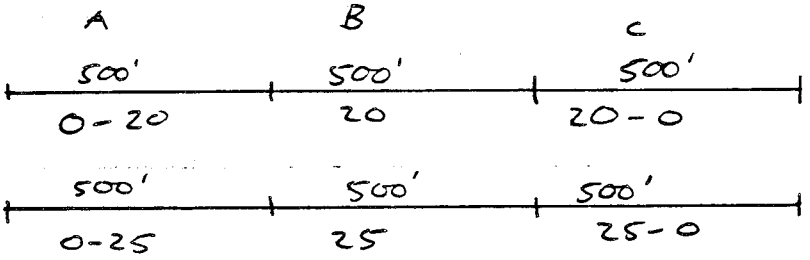
Cost Per CCY = $8.05/ccy ✓

$= \frac{\$4.85}{ton} \times \frac{1\ ton}{2000\ \#} \times \frac{123\ \#}{CF} \times \frac{27\ CF}{yd^3} = \$8.05/ccy$ ✓

LOAD CYCLE

= 1.8 min / truck For 1 CAT 966 LOADER
WITH ASSISTANCE FROM CAT D-8 DOZER
(SEE level B haul roads) ✓

HAUL CYCLE



section	length	avg. speed loaded	avg. speed empty	Travel Time loaded	Travel Time empty
A	500'	10	12.5	0.57 ✓	0.45 ✓
B	500'	20	25	0.28 ✓	0.23 ✓
C	500'	10	12.5	0.57 ✓	0.45 ✓

$time = 500' \left(\frac{1\ mi.}{5280'}\right)(60\ min/hr.)\left(\frac{1}{speed\ mi/hr}\right) = \frac{5.68}{speed\ (mi/hr)}$ (min.)

TOTAL TRUCK CYCLE

exchange time	0.5 minutes ✓
load	1.8 ✓
Haul	1.42 ✓
Maneuver & Dump	0.7 ✓
Return	1.13 ✓

Total Truck Cycle = 5.55 minutes ✓

Subject Landfill Construction - Level B Haul Roads Project No. 86C8554P

By TCK Checked By D. Hawk Task No. 2

Date 3/17/87 Date 3/18/87 File No. 21947

Sheet 3 of 4

No. of Trucks

Exchange & load cycle = 2.3 min. (see level B haul roads)

Need 5.55 minutes / 2.3 min. = 2.41 trucks ✓

use 3 trucks ✓

production estimate based on 2.41 trucks

ESTIMATE PRODUCTION:

1) avg load/cycle-unit

18 CY × 0.9 = 16.2 CCY/unit-load ✓ (see Level B haul Roads)

2) cycles per hour

$\left(\frac{60 \text{ min/hr}}{}\right)\left(\frac{1 \text{ cycle}}{5.55 \text{ min}}\right) = 10.81 \frac{\text{cycle}}{\text{hr}}$

3) Hourly Production Rate

$(16.2 \text{ CCY/load})\left(\frac{10.81 \text{ load/unit}}{\text{hr}}\right) = 175.1 \frac{\text{CCY}}{\text{hr/unit}}$

4) fleet production

(2.41 units)(175.1 CCY/hr-unit) = 422 CCY/hr. ✓

5) check dozer production

1200 CY/hr. × 0.8 CCY/hr. = 960 CCY/hr. > 422 CCY/hr. ✓

6) production adjusted for efficiency (50 min/hr)

(422 CCY/hr.)(50 min/60 min) = 352 CCY/hr. ✓

Subject Landfill Construction - Level D haul road cost Project No. 86C8554P

By T. Kelley Checked By D. Hawk Task No. 2

File No. 21947

Date 3/17/87 Date 3/18/87 Sheet 4 of 4

Equipment List and Costs

1) 2 cat D-8 Dozers @ $123.25 = $246.50/hr. ✓
2) 1 cat 966 loader @ $77.98 = 77.98 ✓
3) 3 18cy end dump trucks @ 58.27 = 174.81 ✓
4) 2 pacers @ 12.76 = 25.52/hr. ✓
5) 1 cat 14G Motor Grader @ = 92.64/hr
Total Cost $617.45/hr. ✓

Cost To Haul From Stockpile and Place

$617.45/hr. / 352 ccy/hr. = $1.75/ccy ✓

TOTAL COST FOR SUPPLYING AND PLACING

$1.75/ccy ✓
$8.05/ccy ✓
TOTAL $9.80/ccy * ✓

* cost w/o safety except 50/60 efficiency

DRAFT GUIDANCE DOCUMENT FOR PERFORMING EXPEDITED RESPONSE ACTIONS (ERA's) 11/27/85

COST FACTORS AS A PERCENTAGE

1. Mobilization	- ranges from 2 to 5% of total direct construction costs; use 5% for preliminary estimate
2. Contingency	- ranges from 15 to 25% of total construction cost; use 25% for preliminary estimate
3. Engineering	- ranges from 7 to 15% of total construction cost; use 15% for preliminary estimate
4. Legal and Administration	- ranges from 1 to 5% of total construction cost; use 5% for preliminary estimate
5. Protection Cost Factor	- see Table 1 for different percentage at various protection levels; use most conservative value for preliminary estimate
6. Equipment O&M Costs	- 3 to 5%/yr of equipment cost
7. Insurance Cost	- 1% of total capital cost
8. Equipment Replacement	- 1% per year of capital cost
9. Labor Fringe Benefits for O&M Costs	- 20 to 30% of wages
10. Start Up and Shake Down Cost	- 5 to 20% of total capital cost; use 20% for complex systems
11. Supervision and Administration during Construction	- 8% of estimated project cost
12. Engineering and Design during Construction	- 15% of estimated project cost
13. Change Order Contingency	- 15% of construction cost
14. Non-component costs associated with a site where an onsite treatment facility will be built from "scratch" (applied to total construction costs).	
site preparation	- 1-10%
piping	- 8-15%
electrical	- 5-12%
instrumentation	- 3-10%

REF: DRAFT GUIDANCE DOCUMENT FOR PERFORMING EXPEDITED RESPONSE ACTIONS (ERA's) 11/27/85

AVERAGE PERCENT INCREASE FOR TOTAL COSTS AT FOUR DEGREE-OF-HAZARD LEVELS*

Unit Operation	Level B	Level C	Level B	Level A
Surface Water Controls:				
1. Surface Sealing - Synthetic Membrane	116%	119%	122%	124%
2. Surface Sealing - Clay	109%	119%	124%	127%
3. Surface Sealing - Asphalt	—	—	—	—
4. Surface Sealing - Fly Ash	—	—	—	—
5. Revegetation	117%	124%	126%	128%
6. Contour Grading	122%	133%	140%	146%
7. Surface Water Diversion Structures	135%	144%	151%	154%
8. Basins and Ponds	125%	138%	145%	150%
9. Dikes and Berms	130%	172%	176%	184%
Ground Water Controls:				
1. Well Point System	110%	117%	121%	128%
2. Deep well System	—	—	—	—
3. Drain System	128%	138%	143%	148%
4. Injection System	—	—	—	—
5. Bentonite Slurry Trench	109%	114%	132%	136%
6. Grout Curtain	—	—	—	—
7. Sheet Piling Cutoff	—	—	—	—
8. Grout Bottom Sealing	—	—	—	—
Gas Migration Controls:				
1. Passive Trench Vents	—	—	—	—
2. Passive Trench Barriers	—	—	—	—
3. Active Gas Extraction Systems	—	—	—	—
Waste Controls:				
1. Chemical Fixation (Solidification)	122%	129%	133%	137%
2. Chemical Injection	—	—	—	—
3. Excavation of Wastes/Contaminated Soil	397%	337%	397%	715%
4. Leachate Recirculation	—	—	—	—
5. Treatment of Contaminated Water	119%	121%	125%	128%
6. Drum Processing	201%	228%	264%	317%
7. Bulk Tank Processing	195%	248%	419%	549%
8. Transformer Processing	—•	293%	—•	—•

- * Values given include 100 percent for base construction costs.
- ✦ This unit operation was deemed appropriate for performance only at Level C. Costs at Levels D, B, and A were not provided.

Source: "Worker Health and Safety Considerations: Cost of Remedial Actions at Uncontrolled Hazardous Waste Sites", Draft Final Report, 1983. SCS Engineers for US EPA, Covington, KY

CONSTRUCTION COST ESTIMATE WORKSHEET
For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87 | SHEET 1 OF 2

PROJECT: RMA

LOCATION: DENVER

PLAN NO.: | ESTIMATOR: T. Kelley | CHECKED BY: D. HAWK

Item descr.		1984 Adjust	Region Adjust		Blue Book monthly Rental	Hourly Rate (173 hr./mo.)	Operating Cost	Army Corps Operator Rates	TOTAL ($/HR.)
TRUCK:									
- Rear Dump									
- ON/OFF HIGHWAY									
- 375 HP Diesel									
- 18 C.Y.		.901	1.05		$4130.00	22.58	18.60	17.09	58.27
TRUCK:									
- REAR DUMP									
- 300 H.P.									
- 12 C.Y.		.901	1.05		$3895.00	21.30	16.00	16.78	54.08
DOZER:									
- CAT D8L		.91	1.05		$12790.00	70.64	32.10		
- Straight blade									
- Angle Tilt		.90	1.05		$170.00	0.93	0.20		
- Cushion		.90	1.05		$385.00	2.10	0.40		
- Total						73.67	32.70	16.88	123.25
DOZER:									
- CAT D6		.91	1.05		5920.00	32.70	13.70	16.88	63.28
SCRAPER:									
- CAT 627B		.887	1.05		14000.00	75.37	42.10	17.03	134.80
COMPACTOR:									
- CAT 825C									
- straight blade		.880	1.05		11,780	62.32	27.60	16.88	107.40
WATER TANKER:									
- 10,000 gal									
- 450 H.P.		.883	1.05		15,575.00	83.47	35.53	17.09	136.11

* U.S. GOVERNMENT PRINTING OFFICE : 1985 O - 476-843

CONSTRUCTION COST ESTIMATE WORKSHEET

For use of this form, see TM 5-800-2; the proponent agency is USACE.

DATE PREPARED: 3-18-87 | SHEET 2 OF 2

PROJECT: RMA

LOCATION: DENVER, CO

PLAN NO.:

ESTIMATOR: T. Kelly

CHECKED BY: D. Hawk

Item descr.		1984 Adjust	Region Adjust		Blue Book Monthly Rental	Hourly Rate (173 hr./mo.)	Operating Cost	Army Corps Operator Rates	Total $/hr.
MOTOR GRADER:									
-CAT 14G		.884	1.05		8310.00	44.59	18.65		
- Automatic Blade control		.882	1.05		1515.00	8.11	1.75		
- 14' width		.882	1.05		385.00	2.06	0.45		
- TOTAL						54.76	20.85	17.03	92.64
LOADER:									
-CAT 966C		.891	1.05		7490.00	40.12	20.65	16.55	77.32
BACKHOE:									
-CAT 245		.843	1.05		19695.00	100.77	41.30	17.03	159.10
TRACTOR:									
-D7RS I-100S		.877	1.05		9405.00	50.06	30.35	16.55	97.29
- DISC NTTACH		.877	1.05		400.00	2.13	0.55	0	2.68
- TOTAL									99.97
LABORER:								12.76	12.76

* U.S. GOVERNMENT PRINTING OFFICE : 1985 O - 476-843

Subject WAGE RATES FOR RMA

Project No. 86C8554P

By D. Hawk

Checked By T. Kelly

Task No. 2

File No. 21947

Date 2/12/87

Date 6/26/87

Sheet 1 of 3

WAGE RATES FOR COST ESTIMATING

REF: GENERAL WAGE DECISION NO. CO86-1

- RMA IS LOCATED IN ADAMS COUNTY, COLORADO T2S, R67W
- BASIN F IS IN SECTION 26

⇒ ELECTRICIANS - AREA 1
PAINTERS - AREA 1
LABORER - GROUP 1 & 2
POWER EQUIPMENT OPERATORS - ZONE 1
TRUCK DRIVERS - ZONE 2

CATEGORY	WORK DESCRIPTION	WAGE	FRINGE	TOTAL
1) ELECTRICIANS	ELECTRICIANS	16.85	2.10 + 3.3%	18.95 +
	CABLE SPLICERS	17.10	2.10 + 3.3%	19.20 +
2) CARPENTERS	ALL	13.90	3.22	17.12
3) CEMENT MASONS	ALL	12.40	3.79	16.19
4) IRONWORKERS	ALL	16.00	3.53	
5) LABORERS	(A) FLAGGERS	7.22	2.24	9.46
	(1) Minimum Labor Fence Erectors Seeding, Stake Chaser, Tie Bar & chairs in concrete, paving.	10.52	2.24	12.76
	(2) Hydraulic & Electrical Tools Torches, drills, tampers jackhammers, form setters concrete saws, asphalt labor, pipelayer, conduit, pump operator	10.57	2.24	12.81

Subject WAGE RATES FOR RMA

Project No. 86C8554P

By D. HAWK

Checked By T Kelly

Task No. 2

File No. 2947

Date 2/12/87

Date 6/16/87

Sheet 2 of 3

CATEGORY	WORK DESCRIPTION	WAGE	FRINGE	TOTAL
6) POWER EQUIPMENT OPERATORS	① Air Compressor, Mechanic, Welder Light plants, Single unit conveyor Pumps, Tractor under 70 HP ≤ 360 cfm Compressor	12.41	3.77	16.18
	② Conveyor, building materials, trenching Pugmill, Self-propelled roller, rubber tired under 5 tons	12.76	3.77	16.53
	③ Asphalt Plant, Concrete batching, Finish Machine Paving, Hoist 1 drum, Hydraulic backhoes under 3/4 cy, Loader ≤ 6 cy, Motor grade (rough), rollers over 5 tons, 70 HP over tractor	13.11	3.77	16.88
	④ Crane and backhoes 5 cy and under Hydraulic Hoe 3/4 cy and over, Loader over 6 cy, Mechanic Finish motor grader Multiple Unit Crusher Scraper ≤ 40 cy Welder	13.24	3.77	17.03
	⑤ Heavy-duty mechanic welder, Scraper > 40 cy	13.41	3.77	17.18

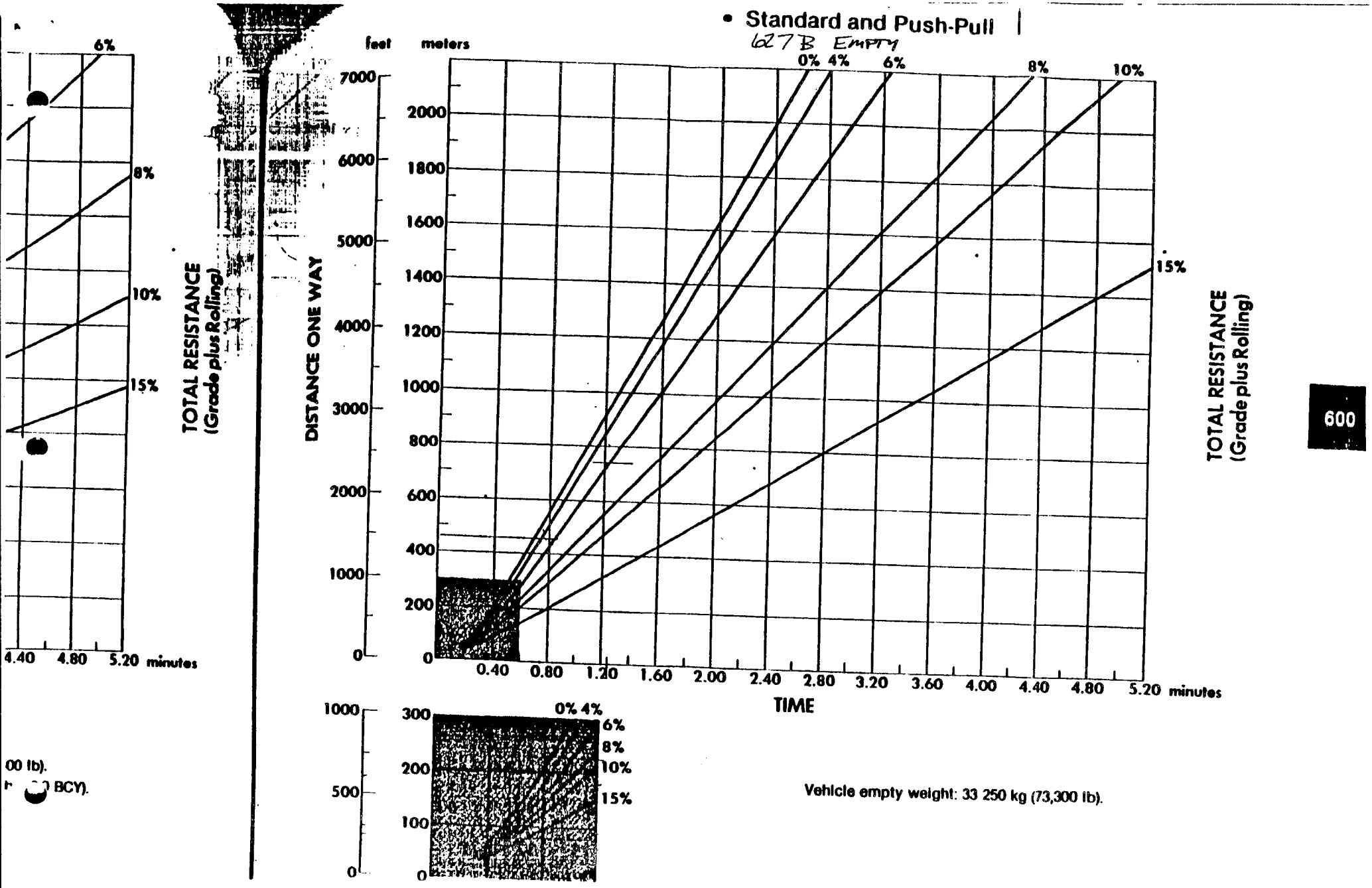
Subject WAGE RATES FOR RMA — Project No. 86C8554P

By D. HAWK — Checked By T. Kelly — Task No. 2

Date 2/12/87 — Date 6/26/87 — File No. 21947

Sheet 3 of 3

CATEGORY	WORK DESCRIPTION	WAGE	FRINGE	TOTAL
1) TRUCK DRIVERS	① PICK-UP, TRUCK DRIVER TENDERS, DUMPMEN, GREASERS	12.88	3.64	16.52
	② Truck Driver ≤ 6 CY Flat bed Single axle Shuttle truck, Single axle liquid tanker	13.01	3.64	16.65
	③ Flat rack tandem axle, mechanics tenders, dump 6 TO 11 CY	13.14	3.64	16.78
	④ Straddle Truck, Lumber Carrier	13.21	3.64	16.85
	⑤ Fork Lift, Fuel Truck	13.26	3.64	16.90
	⑥ Cement Mixer to 10 CY	13.33	3.64	16.97
	⑦ Multi-purpose ; Hoist	13.38	3.64	17.02
	⑧ Dump truck > 11 CY but < 20 CY, semi liquid tanker, bulk tanker	13.45	3.64	17.09
	⑨ Truck driver, snow plow	13.58	3.64	17.22
	⑩ Cement mixer 10 to 15 CY	13.64	3.64	17.28
	⑪ Dump truck 20 to 39 CY	13.76	3.64	17.40
	⑫ Tire men, dump truck 39 to 54 CY	14.01	3.64	17.65
	⑬ Cement Mixer > 15 CY	14.06	3.64	17.70
	⑭ mechanic	14.13	3.64	17.77
	⑮ Heavy Duty diesel mechanic, body man welders	15.51	3.64	19.15
	⑯ Highboy, Lowboy, Semi	15.76	3.64	19.40

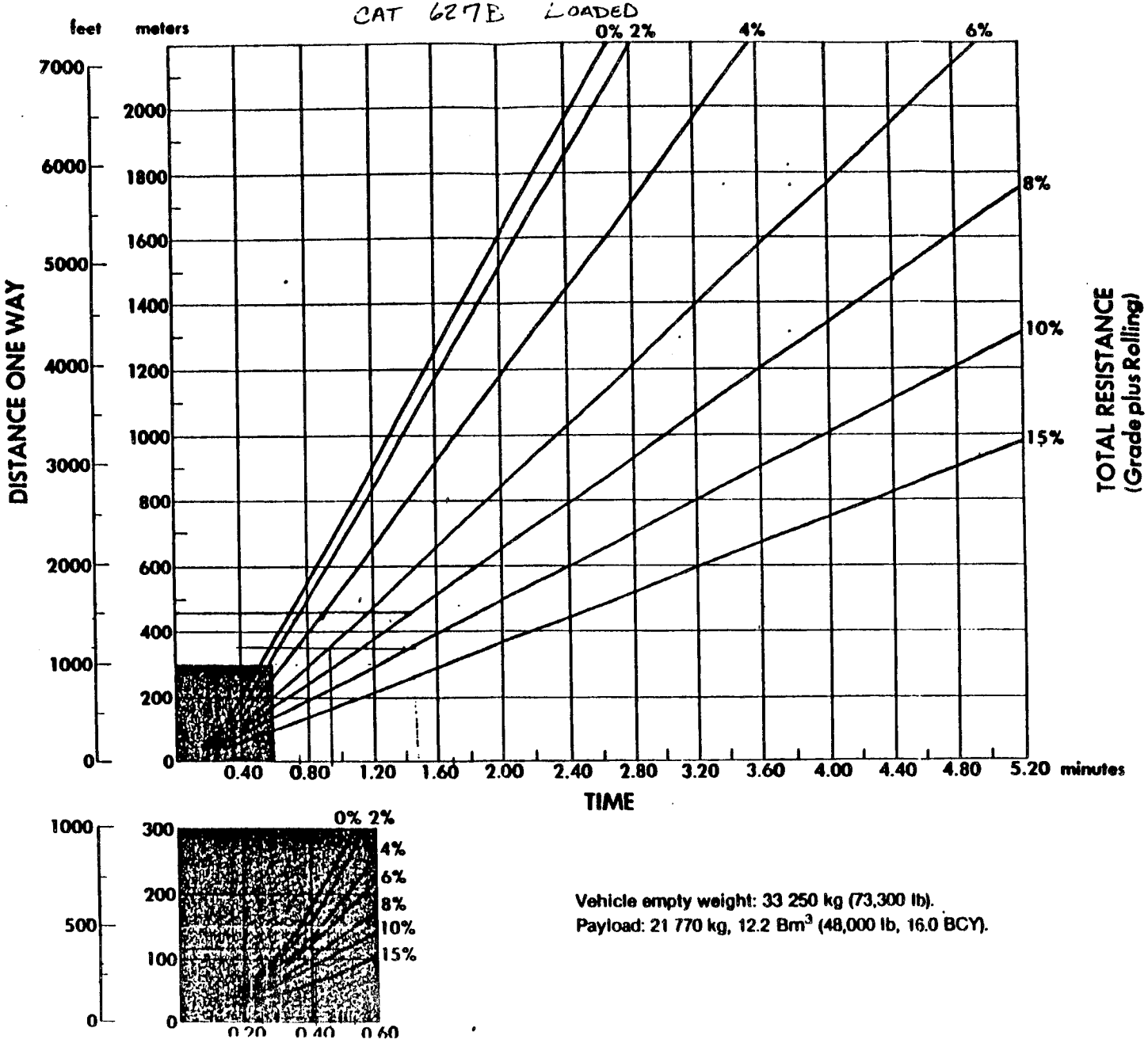

• Standard and Push-Pull
627B Empty
0% 4% 6% 8% 10% 15%
TOTAL RESISTANCE (Grade plus Rolling)
DISTANCE ONE WAY
feet
meters
7000
6000
5000
4000
3000
2000
1000
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.40 0.80 1.20 1.60 2.00 2.40 2.80 3.20 3.60 4.00 4.40 4.80 5.20 minutes
TIME
TOTAL RESISTANCE (Grade plus Rolling)
6%
8%
10%
15%
4.40 4.80 5.20 minutes
1000
500
0
300
200
100
0
0% 4%
6%
8%
10%
15%
Vehicle empty weight: 33 250 kg (73,300 lb).

600

00 lb).

BCY).

CAT 627B LOADED



Vehicle empty weight: 33 250 kg (73,300 lb).
Payload: 21 770 kg, 12.2 Bm^3 (48,000 lb, 16.0 BCY).

Subject HEALTH AND SAFETY COSTS — Project No. 86C8554P

By D. HAWK — Checked By T. KELLEY — Task No. 2

Date 3/17/87 — Date 3/18/87 — File No. 21947

Sheet 1 of 2

DIRECT HEALTH AND SAFETY COSTS FOR EQUIPMENT

D CAT 627 B SCRAPER & OPERATOR (HEAVY EQUIPMENT)

a) + Enclosed CAB (RANGE 240.00-605.00/mo)	=	425.00/mo
b) Air Conditioner	=	150.00/mo
c) Air Cylinders $15/day @ 1/60	=	385.00/mo
d) Protective Clothes 1 change/shift	=	3085.00/mo
e) Dress/decon 2 hr/day @ $17.03/hr	=	875.00/mo
f) 1/4 Standby Operator @ 17.03/hr @ 10 HRS/DAY	=	1095.00/mo
TOTAL MONTHLY	=	$6015/mo.

One time costs

a) Brackets for cylinders	=	$500.00
b) Air line System	=	400.00
c) Communication System (Light)	=	200.00
d) First Aid Kit	=	25.00
e) Fire Extinguisher	=	40.00
f) Level B training	=	$1500.00
g) Physical (2) @ 450.00/ea	=	$900.00
TOTAL 1-TIME	=	$3565.00
ASSUME 6 mo	=	$595/mo.

TOTAL MONTHLY COST CAT 627 B SAFETY = $4610.00/mo

ASSUME 173 HR/mo — TOTAL HOURLY COST = $26.20/HR.

+ Average cab cost used for this cost $\frac{240.00 + 605.00}{2} = \$425.00$

Scrapers @ low end 240.00/ea - 627B
Dozers @ high end 605.00/ea - D8

NOTE: USE 6 WORKDAYS/WEEK AND 30 CALENDAR DAY MONTH

Subject HEALTH & SAFETY COSTS — Project No. 86C8554P

By D HAWK — Checked By T KELLEY — Task No. 2

File No. 21947

Date 3/17/87 — Date 3/18/87 — Sheet 2 of 2

DIRECT HEALTH & SAFETY FOR LABORERS IN AIR PACKS

1) EACH LABORER WILL BE ON 30 MINUTE PACKS WITH 5 MINUTE HIP PACKS. ABOUT 1.5 BACK-UP LABORERS WILL BE REQUIRED IN ROTATING FASHION PER LABORER. THIS WILL ALLOW FOR 30 minutes on - 30 minutes off - 15 min WALK TO AND FROM POST / 2 LABORER. FIVE CHANGEOUTS OF DISPOSABLE GARMENTS ARE ASSUMED.

DAILY CHARGES

a)	PROTECTIVE CLOTHES	=	$43.00/DAY
b)	5 Changeouts @ $16.00	=	$80.00/DAY
c)	1.5 LABORERS @ $12.76/HR × 8HR	=	$153.12/DAY
d)	Protective clothes for extra laborers 1.5($123.00)	=	$184.50/DAY
e)	SCBA Refill 2.5 × 45/75 ($315.00)	=	$22.50/DAY
f)	DRESS/DECON 2.5 × 2HR = 12.76/HR	=	$63.80/DAY
	TOTAL DAILY	=	$546.92/DAY

ONE TIME CHARGES / 6 MO.

a)	LEVEL B TRAINING 1500.00 × 2.5	=	$3750.00
b)	COMMUNICATION SYSTEM 100.00 × 2.5	=	$250.00
c)	SCBA 2.5 × 1500.00	=	$3750.00
d)	RUBBER BOOTS 20.00 × 2.5	=	$50.00
e)	PHYSICALS 2 @ 450.00 × 2.5	=	$2250.00

TOTAL ONE TIME = $10,050

ASSUME 6 MO = $1675/MO.

TOTAL HOURLY COSTS

546.92/8 + 1675/173 = $78.05/HR

Note: This labor charge should be used only where air lines are impractical and production does not depend on laborer.

Subject HEALTH AND SAFETY COSTS - STANDBY EQUIPMENT Project No. 86C8554P

By T. KELLEY Checked By D HAWK Task No. 2

File No. 21947

Date 3/18/87 Date 3/18/87 Sheet 1 of 1

NON-OPERATIONAL HEALTH AND SAFETY COST FOR STANDBY EQUIPMENT

1) ONGOING RENTAL:

a) Enclosed Cab (Range 240.00 - 605.00/mo) = $425.00/mo

b) Air Conditioner = $150.00/mo

TOTAL MONTHLY $575.00/mo ✓

2) ONE TIME COSTS

a) Brackets For Cylinders	$500.00
b) Airline System	$400.00
c) Communication System (Light)	$200.00
d) First Aid Kit	$25.00
e) Fire Extinguisher	$40.00

TOTAL 1-Time $1,165.00 ✓

ASSUME FOR 6 mo. $194.00/mo ✓

TOTAL MONTHLY STANDBY EQUIPMENT COST

SAFETY COST = $769/mo ✓

ASSUMING 173 HR/mo, STANDBY HOURLY = $4.44/HR

Say $4.45/HR. ✓

DATE: 3/19/87 AM PM TIME: 2:50	TELEPHONE MEMORANDUM	PROJECT NO. 86C8554P
(TO) (FROM) MR. Bob Adams COMPANY Tyler Construction Co. RECORDED BY Dan Hauk PROJECT RMA.		ROUTING 1) JRO FILE 21947 T2

Bob called back with estimates for level B equipment modifications. The following information was provided.

1) Quote in Bob's files for heavy equipment $175.00/day/machine
   For monthly rate $2100.00/month/machine (includes 1 Decon
2) Enclosed cab only: CAT 627B $275.00/mo.
   CAT 966 $340.00/mo.
   CAT 235 $250.00/mo.
   CAT D6 $410.00/mo.
   CAT D8 $605.00/mo.
3) Air Conditioner - Standard $150.00/mo./machine
4) Breathing Device Brackets outside of cab
   - one time expend $500.00/machine
   - negligible operating cost.
5) Consider Hazardous Waste Premium due to risk involved. Contractors will rent higher than expected. With six months guaranteed rental the price will become refined (less contingency). Six months is not considered short term and will provide incentive.

RECORD OF VERBAL QUOTE

Project: Name: Rocky Mtn. Arsenal

Location: Denver

Quote #: 1 MISC. (Estimate Sht. No. _____)

Firm: Name: Henry's Safety + Supply

Location: Golden, CO

Telephone No.: (303) 279-8811

Person Talked To: Ron

Type of Quote: ✓ Supplier, material only (FOB Point: _____)

_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

5 minute escape packs mask, 5 min. bottle belt, pigtail — $612

TOTAL AIRLINE ~$400.00

Airline	$169.30 for 100ft $105 for 50ft
pigtail	$13.40 each
T's	[redacted] $14.50 each
Regulator w/ filter	$145 w/o filter $105
Alarm (<500psi in cylinder)	$93 each

Microphone

Loud mouth (throat mic)	$198
Throat mic w/ radio transmitter and head set (Earmuff)	$1840

Survivair 60 min SCBA (3416) — $1795 list price

30min SCBA (2316)

Date Quote Received: _____

Quote Received By: _____

RECORD OF VERBAL QUOTE

Project: Name: Rocky Mtn. Arsenal
Location: Denver

Quote #: 2 MISC. (Estimate Sht. No. _____)

Firm: Name: Air Products
Location: Denver
Telephone No.: (303) 329-9353
Person Talked To: Dan Hiteras

Type of Quote: X Supplier, material only (FOB Point: RMA)
_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

They truck in all their air from Kansas.
Not certified to pump air in Denver from their facility.

$ 15 / cylinder

No delivery or pick-up charge
$3.95 charge per cylinder if kept past the end of the month

Date Quote Received: 3/17/87
Quote Received By: Risa Gerhart

RECORD OF VERBAL QUOTE

Project: Name: RMA

Location: Denver, CO

Quote #: 3 misc. (Estimate Sht. No. _____)

Firm: Name: Air Products

Location: Denver

Telephone No.: (303) 329-9353

Person Talked To: Dan

Type of Quote: X Supplier, material only (FOB Point: _____)

_____ Subcontractor, material installed (Cost to Prime)

Scope/Description/Amount of Quote:

New quote:

If they are looking at 30-40 cylinders a day they will get certified to pump air in Denver.

They will charge $8.50 cylinder

$3.00 per cylinder for every cylinder kept past the end of the month.

Date Quote Received: 3/20/87

Quote Received By: Lisa Merhart